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JOURNAL

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ABSTRACTS OF CHEMICAL PAPERS PUBLISHED IN BRITISH AND FOREIGN JOURNALS.

PART II.

General and Physical Chemistry.

Molecular Refraction and Dispersion of very Dilute Solutions. By D. Dijken (*Zeit. physikal. Chem.*, 1897, **24**, 81—113).—The refractive indices of a number of dilute salt solutions were determined, and the molecular refraction of the dissolved salt calculated by means of Gladstone's expression; this value is found to be a constitutive property, as is shown in the appended table.

	Cl.	NO_3.	$\frac{1}{2}SO_4$.
NH_4—$\frac{1}{2}$Mg	7·7	7·8	7·8
NH_4—$\frac{1}{2}$Zn	6·8	6·0	6·0
NH_4—Li	7·8	7·1	7·7
NH_4—Na	6·7	6·9	6·7
NH_4—K	3·4	3·6	3·4
NH_4—H	8·0	8·2	8·4
K—Na	3·3	3·3	3·3

The molecular refraction of ammonium chloride is 22·5, of the nitrate 25·8, and of the sulphate ($\frac{1}{2}SO_4$) 19·9, and from these values those of the other salts can be readily obtained. L. M. J.

Red Spectrum of Argon. By Josef Maria Eder and Eduard Valenta (*Monatsh.*, 1895, **16**, 893—895).—By means of a concave grating, the spectrum of argon at a pressure of 1—3 mm. was obtained,

and the wave-lengths of the lines measured reduced to Rowland's scale. Both the red and blue spectra were obtained, and a table of the wave-lengths of the lines of the red spectrum from 5060 to 3319 is given. The following are given as specially characteristic: λ = 4628·56, 4596·22, 4522·49, 4510·85, 4300·18, 4272·27, 4259·42, 4251·25; the group 4200·76, 4198·42, 4182·07, 4164·36, and 4158·63; and further, 4044·56, 3949·13, 3834·83. When the dispersion is good, the double line 4191·15—4190·75 should show up plainly in the red spectrum of argon.
H. C.

Chemistry of the Hottest Stars. By Sir J. Norman Lockyer. (*Proc. Roy. Soc.*, 1897, 61, 148—208, and 213).—The author summarises his own investigations and those of others on the spectra of metals at high temperatures and on stellar spectra, and arrives at the following general conclusions.

In a mixture of vapours at a particular temperature, a vapour which is not present in sufficient quantity to show all the lines of its spectrum will be represented by the lines which are longest in its spectrum at the particular temperature in question. Only some of the short lines in metallic spectra represent the effects of high temperature. Some of the substances which have been investigated, including iron, calcium, and magnesium, have probably a definite spectrum, consisting of a few lines, which can only be completely produced at a temperature higher than any which is at present available in laboratory experiments. The lines constituting the new spectra are those which either appear only in the spark spectrum, or are lengthened in passing from the arc to the spark; such lines are termed enhanced lines. In the case of iron, calcium, and magnesium, there are four distinct temperature steps which are marked by spectral changes: (*a*) The flame spectrum, (*b*) the arc spectrum, (*c*) the spark spectrum, (*d*) a spectrum consisting solely of those lines which are enhanced in passing from the arc to the spark.

The order of temperature of certain stars, as determined from a comparison of the extensions of the continuous spectrum into the violet or ultra-violet, is precisely the same as that which follows from a comparison of the metallic spectra at the four stages of temperature. The variations of the metallic lines furnish the most convenient means of determining relative stellar temperatures, for the reason that photographs with special exposures are unnecessary. Having ascertained the relative temperature of a star in this way, and assuming that all the absorbing vapours are at the same temperature, the presence or absence of any other metallic substance can be determined by looking for the lines which are longest in its spectrum at that temperature. In the case of the hottest stars, the fourth stage spectrum must be the term of comparison.

Accepting the new results with regard to the lines enhanced in the spark, several lines in the spectra of the hottest stars, for which no origins could previously be assigned, can now be ascribed to metallic substances at the fourth stage of temperature. The lines of the cleveite gases appear only in the hotter stars, as indicated by the extension of the continuous radiation into the ultra-violet, and they increase in intensity with increased temperature in certain stars. The order of stellar temperatures, determined from the *increasing* intensity of the lines of the cleveite gases, is identical with that determined from the *decreasing* intensity of the metallic lines in the case of those stars which show both series of lines.

Different substances are spectroscopically visible through different ranges of stellar temperatures. The hydrogen lines are visible in stars ranging in temperature from that of α-Orionis to that of Bellatrix, whilst those of the cleveite gases do not appear below the temperature of α-Cygni. The enhanced lines of calcium appear at temperatures as low as α-Orionis, and persist, with reduced intensity, to the temperature of Bellatrix; those of iron do not appear at temperatures lower than that of α-Cygni, and disappear altogether at the temperature of Bellatrix; while the enhanced line of magnesium appears at the temperature of α-Cygni, and remains feebly visible at the temperature of Bellatrix. It follows, then, that the enhanced metallic lines may be absent from a stellar spectrum, either because the temperature is too low or too high.

In the case of those stars which previous investigations have shown to be cooling, the metallic line phenomena are inverted. The enhanced lines first become visible, then the arc lines; but whereas the enhanced lines disappear at a certain stage in the process of cooling, the arc lines continue to become stronger. The lines of the cleveite gases show a similar inversion on the downward side of the temperature curve; strongly represented in the hottest stars, they thin out very rapidly in cooling stars, and disappear before the arc lines have begun to show themselves.

Utilising the iron lines as a method of bringing together stars of approximately equal temperature, it is found that at each stage the stars are divisible into two groups, which, in accordance with the author's previous work, correspond with increasing and decreasing temperatures respectively. As determined in this way, stars of increasing temperature differ from those of decreasing temperature at the same stage of heat: (1) in the greater continuous absorption in the violet or ultra-violet; (2) in the generally greater intensity and breadth of the metallic lines; (3) in the smaller thickness of the hydrogen lines; (4) in the greater thickness of the helium lines at those stages at which they are visible. These differences are all explained on the meteoritic hypothesis. There are stars, near and at the top of the curve, which cannot be arranged in order of temperature by the criteria referred to, for the reason that the iron lines have disappeared, and the lines of hydrogen and cleveite gases show little variation. The arrangement of stars about the top of the curve will depend on the conditioning of certain lines, at present of unknown origin; the necessary criteria, therefore, require further investigation.

The known facts with regard to changes in the line spectrum of an element can be easily explained on the hypothesis of successive dissociations analogous to those observed in the case of undoubted compounds. Similarly, the differences in the lines representative of a metal such as iron in the spectra of sun-spots, prominences, chromosphere, or different stars, are explained by supposing that there are different molecular groupings at each stage of temperature. The change from a continuous spectrum to one consisting of flutings, and afterwards to one of lines, is now acknowledged to be due to the existence of different molecular combinations. The recent investigations of Humphreys and Möhler on the shifts produced in metallic lines, confirm the author's view that the line spectrum of a metal integrates for us the vibrations of several sets of molecules. It is argued that the existence of "series" of lines in the spectra of some chemical elements is another indication of molecular complexity, each series probably representing the vibrations of similar molecules. The behaviour of the magnesium lines in stellar spectra is ascribed by Schreiner to differences of temperature, in accordance with the author's experimental results of 1879. The experiments on the spectrum of mercury which have been made by Eder and Valenta (Abstr., 1896, ii, 2) have revealed variations which, according to them, favour the dissociation hypothesis.

On various grounds, the view that the differences in stellar spectra represent fundamental differences of chemical composition is untenable; the fact that many stars that are widely separated in space give identical spectra, indicates that they not only contain the same "elements," but that the "elements" exist in the same proportions in all. On the non-dissociation hypothesis, the action of heat on the sun's chromosphere could not produce such a spectrum as that which we know to be associated with hotter stars, since the relative proportions of different vapours could not be changed; the only change which can be imagined to take place on this hypothesis, is a reduction of intensity of all the lines due to reduced pressure.

On the dissociation hypothesis, increased temperature would bring about fundamental changes in the spectrum, due to molecular simplifications, and in this way the effect of an increase of temperature on the sun's chromosphere, as indicated by hotter stars, can be predicted, and receives a simple and sufficient explanation. The disappearance of the enhanced iron lines in the hottest stars, and the simultaneous intensification of the lines of hydrogen, helium, and an unknown gas X, bring us face to face with the fact that iron is a compound into the ultimate formation of which one or all of these gases enter. The ultimate molecules of the chemical elements discussed in this paper are arranged by the author in the following order of resistance to the effects of temperature: Gas X, helium, hydrogen, calcium, magnesium, iron.

The author concludes by claiming that laboratory, solar, and stellar evidence has more and more demonstrated the truth of the dissociation hypothesis, and that we can now acknowledge that the phenomena of the inorganic world are dominated by an evolution not less majestic, although much more simple, than that now universally accepted in the case of organic nature. H. C.

Chemical Constitution of the Stars. By ARTHUR SCHUSTER (*Proc. Roy. Soc.*, 1897, 61, 209—213).—While agreeing with Lockyer's general statement (see preceding abstract) that the chemical elements in the stars are the same as those in the sun, the author is not convinced that the difference in the spectra of stars is not due to a real difference of constitution. Some of the stars which are now in an early stage of development may be forming through the condensation of matter which has been left over by others; and it would not be surprising if the youngest star did not agree in constitution with its aged companions. If Lockyer's dissociation hypothesis is correct, we must look forward to finding some trace of helium, or calcium, or hydrogen in the discharge taken from iron poles. Not till then will this hypothesis be considered as proved. H. C.

Two New Galvanic Cells. By H. Pauling (*Zeit. Elektrochem.*, 1897, 3, 332—333).—The first cell described has carbon electrodes immersed respectively in concentrated chlorine water and sodium thiosulphate solution, the liquids being separated by a porous pot soaked in brine. The electromotive force fell, on short circuit, from 0·64 volt to 0·47 volt and then remained constant for 5 hours, the current passing being 0·7 amp. Sulphur separates out in the thiosulphate solution.

In the second cell, the electrodes are iron and carbon respectively, and the electrolyte a concentrated solution of ferric chloride, the reactions which take place, according to the author, being $3FeCl_3 = 3FeCl_2 + 3Cl$ and $Fe + 3Cl = FeCl_3$. The ferrous chloride formed is reconverted into ferric chloride by means of chlorine gas. The electromotive force of the cell is 0·9 volt and its principal advantages are its freedom from smell and cheapness. A simple mode of construction is described in which a constant flow of ferric chloride solution is maintained through the cell so as to ensure efficient depolarisation. T. E.

The Iron-Carbon-Ferric Chloride Cell. By Friedrich W. Küster (*Zeit. Elektrochem.*, 1897, 3, 383—385).—The process occurring in the cell described by Pauling (see preceding abstract) is better represented by the equation $2Fe''' + Fe = 3Fe''$, the dashes indicating the number of positive charges of electricity.

Since the iron is always contaminated with finely divided carbon or iron carbide, local galvanic action must occur of the same kind as the main reaction taking place in the cell. That this is the case was proved by an experiment in which the iron plate lost 1·66 grams in weight, whereas the loss corresponding to the quantity of electricity produced should have been 0·31 gram.

That the iron dissolves as ferrous chloride and not as ferric salt was shown by immersing the iron plate in a solution of sodium chloride and the carbon plate in a solution of ferric chloride. After allowing the current to pass for some time, the solution in the vicinity of the iron plate was found to contain ferrous salt alone without a trace of ferric iron. T. E.

Determination of the Resistance of Galvanic Cells with small Polarisation Capacity. By Ernst Haagn (*Zeit. Elektrochem.*, 1897, 3, 470—471. See also Gordon, *ibid.*, 3, 162, 1896; and Haagn Abstr., 1897, ii, 393).—If the resistances in the arms of a Wheatstone bridge are R_1, R_2, R_3, and R_4 (R_3 and R_4 referring to the halves of the bridge wire), and the arms 1 and 2 contain in addition capacities C_1 and C_2, balance is obtained when $R_1/R_2 = R_3/R_4$ and $R_3/R_4 = C_2/C_1$ simultaneously. The present method is based on this. The cell of which the resistance (R_1 say) is to be measured has a capacity C_1. The measurements are made by the telephone method, and in order to get a good minimum, the arm of the bridge containing the comparison resistance R_2 must also contain a condenser of capacity C_2 fulfilling the requirements of the above equation. A suitable condenser may be made by immersing two aluminium plates in sulphuric acid of maximum conductivity; a current is then passed between them with an E. M. F. of about 10 volts for a minute, when the aluminium plates become polarised so that a smaller E. M. F. than 10 volts causes no current to pass in the same direction, and this condition is retained for a considerable period. The capacity of the condenser is varied by varying the depth to which the plates are immersed in the acid. In order to prevent direct current from the cell passing through the telephone circuit, an air condenser is included in it. The measurement is made by first adjusting the bridge contact to an approximate minimum of sound in the telephone, a nearer approximation is obtained by adjusting the depth of immersion of the aluminium plates, and then the final adjustment of the bridge contact is made. The method is applicable whether current is flowing through the cell or not.

T. E.

Theory of Accumulators. By Fritz Foerster (*Zeit. Elektrochem.*, 1897, 3, 525—531).—The author discusses the rival theories of the action taking place in a lead accumulator, supported on the one hand by Le Blanc, on the other by Liebenoff and Löb (Abstr., 1897, ii, 239, 300, 394). According to Le Blanc, the lead peroxide passes into solution, during the discharge, in the form of hydroxyl ions and quadrivalent lead ions, the latter then give up half their charge to the anode and are converted into bivalent lead ions. During the charging, salts of quadrivalent lead are formed at the anode which are hydrolysed, depositing lead peroxide. According to Liebenoff, solutions of lead salts contain some $\overset{--}{\mathrm{PbO}_2}$ ions which simply lose their charge at the anode, being converted into lead peroxide, the reverse change occurring during discharge. The author supports Le Blanc's view on the grounds that quadrivalent lead ions really are formed at the anode when lead salts are electrolysed [the salt $(NH_4)_2PbCl_6$ may be prepared by the electrolysis of a solution of $PbCl_2$ and NH_4Cl at 0°]. Further, according to the theory, the process of discharge is not a complete reversal of the charge, which explains the fact that the whole of the electrical energy used in charging cannot be recovered, and finally reactions in which an ion loses part of its charge are very numerous; a summary of such reactions is given. On the other hand, if Liebenoff's theory is accepted, we should expect solutions of zinc oxide or copper oxide in alkalis to deposit peroxides in the same way as a solution of lead oxide. This difficulty is avoided by assuming the formation of quadrivalent lead ions, because neither zinc nor copper is capable of forming ions of higher valency than two.

T. E.

Influence of Manganese Compounds on Lead Accumulators. By Georg von Knorre (*Zeit. Elektrochem.*, 1897, 3, 362—364).—A freshly charged positive accumulator plate placed in dilute sulphuric acid containing a little manganese sulphate quickly oxidises the latter to permanganic acid. The same result is obtained with lead peroxide although more slowly. The formation of permanganic acid is also observed when manganese peroxide is deposited in any way on the accumulator plate.

A negative accumulator plate quickly decolorises dilute sulphuric acid coloured red with permanganate. Pure spongy lead has the same effect. It follows, therefore, that manganese compounds in lead accumulators merely serve to carry oxygen from the positive to the negative plates, thereby discharging the cells. T. E.

Depolarisation of Mercury and Platinum Electrodes. By Karl R. Klein (*Ann. Phys. Chem.*, 1897, [ii], 62, 259—279).—The size of the polarised electrode, as long as this remains small in comparison with the other electrode, has no influence on the depolarisation. The rate of depolarisation decreases as the time occupied by the preceding polarisation increases, moreover, the rate of depolarisation increases with the temperature. The presence in the electrolyte of a salt, the metallic radicle of which is the same as the metal of the electrodes, and the acid radicle that of the electrolyte, increases the rate of depolarisation of the cathode. The rate of depolarisation of platinum electrodes is generally smaller than that of mercury electrodes in the same electrolytes. Anodic polarisation disappears at a slower rate than that of the cathode. H. C.

Temperature Coefficient of the Potential of the Calomel Electrode with various Dissolved Electrolytes. By Theodore W. Richards (*Zeit. physikal. Chem.*, 1897, 24, 39—54).—The temperature coefficient of a calomel electrode in the chain Hg | HgCl | MCl | HgCl | Hg was found by Gockel (*Ann. Phys. Chem.*, 1885, 24, 618), to vary considerably with the salt employed, a result at variance with theoretical deductions. The author therefore repeated Gockel's experiment, employing solutions of various chlorides at various concentrations. In the case of hydrogen chloride, the temperature coefficient was found to increase rapidly with the dilution, and the presence of small quantities of impurities was shown to have but little effect, the coefficient, moreover, decreasing with rise of temperature. The variations were found to be due to the formation of mercuric salts, $Hg_2Cl_2 = HgCl_2 + Hg$, and this reaction is largely dependent on the concentration of the dissolved chloride, but is only slightly affected by its nature. With N/10 and N/100 solutions, the effect is comparatively unimportant, and for these the observed values for the temperature coefficient are compared with those calculated by aid of a formula derived from Nernst's expression $\pi = RT/\epsilon_0 . \log . P/p$. The nature of the kation only affects the value by changing the degree of dissociation, and the values agree with the observed numbers very satisfactorily except in the case of hydrogen chloride and ammonium chloride, both of which behave irregularly.

(Note.)—No reference is made to Gockel's later paper (*Ann. Phys. Chem.*, 50, 696, Abstr., 1894, ii, 78). L. M. J.

Currents with Polarisable Electrodes. By Ernst Salomon (*Zeit. physikal. Chem.*, 1897, 24, 55—80).—In an electrolytic cell, the current produced by small electromotive forces is given by the expression $I = (E - E')/R$ where E is the E. M. F. and E' the E. M. F., due to polarisation; the author's experiments were performed to prove that the polarisation E. M. F. may be calculated by Nernst's formula, $E_1 = 0{\cdot}058 \log. (c_2/c_1)$, the ratio c_2/c_1 being calculable from the diffusion coefficients, the polarising E. M. F., and the total concentration of the ions. The experimental methods are described, diagrams of the apparatus being given together with tables of the calculated and observed values for the current strength. The first set of tables for silver salts show no agreement, and the author finds this is always the case when the solutions are quite neutral. When, however, the solutions are made slightly alkaline or acid, the values obtained agree well with the calculated numbers in the case of silver salts, but with copper and lead salts, secondary reactions render comparisons valueless. By reverse calculation, it is possible to determine the concentration of the ions from the current strength, and the author in this manner finds the solubility of silver chloride to be $81{\cdot}4 \times 10^{-7}$ gram-molecules per litre [118×10^{-7} Kohlrausch]. If silver electrodes are employed in a potassium chloride solution, no current passes if the E. M. F. is small; on the addition of silver nitrate, the current is very small until all the chloride has been precipitated, when it increases enormously, so that this increase may be used to indicate the end point of a titration, the author finding the indication sensitive to 1/100 c.c. in the case of a 0·7N solution. L. M. J.

Dielectric Constants of certain Frozen Electrolytes at and above the Temperature of Liquid Air. By John Ambrose Fleming and James Dewar (*Proc. Roy. Soc.*, 1897, 61, 299—316. Compare Abstr., 1897, ii, 475).—The dielectric constants at low temperatures of a number of frozen electrolytes were determined. Frozen electrolytes at low temperatures are capable of acting as dielectrics even in the case of those substances which in the liquid state and in aqueous solutions have relatively a very high electrolytic conductivity. At temperatures not far below their freezing points, these electrolytes have dielectric constants of large value, and numerically of the order of that of ice or water at 0°, or in some cases much larger, as, for example, with 5 per cent. and 10 per cent. solutions of sodium and potassium hydroxide. The majority of these high dielectric values, so far as observed, are reduced to very much lower values (near to 3) when the dielectrics are cooled to, and below, the temperature of liquid air. Certain aqueous solutions of potassium hydroxide retain their high dielectric values to nearly the liquid air temperature, but give indications of being reduced at lower temperatures to small values. A 5 per cent. alcoholic solution of caustic potash behaves quite differently from the 5 per cent. aqueous solution, and has a much lower dielectric constant at $-185°$. Frozen electroyltes at very low temperatures have very great insulating power, but recover sensible conductivity with great rapidity at temperatures far below their melting points. It appears probable that at the absolute zero of temperature all electrolytes become perfect non-conductors of electricity or have infinite resistivity, and also that it is possible their dielectric constants may be all reduced to, or represented by, a number near to 2 or 3 at that temperature, that of a vacuum being taken as unity. H. C.

Dielectric Constants of Pure Ice, Glycerol, Nitrobenzene and Ethylenic Dibromide at and above the Temperature of Liquid Air. By John Ambrose Fleming and James Dewar (*Proc. Roy. Soc.*, 1897, **61**, 316—330).—The dielectric constant of pure ice at the temperature of the melting point is represented by a number not far from 80, but an enormous decrease in the constant takes place in cooling from 0° to – 185°, so that at – 185° the value obtained is about 2·42. As the dielectric constant of water decreases when the temperature is raised above 4°, it follows that there is unquestionably some temperature at which ice-water has a maximum value for its dielectric constant. Experiments made with ice from ordinary distilled water indicate that this temperature may, and probably does, vary with the presence of slight impurities in the water, and with the frequency of the electromotive force reversals.

The dielectric constant of glycerol is found to increase rapidly with rising temperature between – 185° and – 52°, the resistance at the same time falling.

Ethylenic dibromide presents a remarkable contrast to water or glycerol; its dielectric constant at 15° has a value of about 5, it falls on freezing to nearly 3, and it continues nearly constant down to the lowest temperature reached, at which it becomes 2·7. When cooled down after freezing, its resistance also remains exceedingly high and constant.

In the case of nitrobenzene, the dielectric constant, on solidification at 3°, falls somewhat rapidly from the high value of 32 to a low value of between 3 and 4, and ultimately reaches 2·61 at – 185°. The resistance remains practically constant and exceedingly high during the rise of temperature from – 200° upwards.

From the results, it appears that water, glycerol, ethylic alcohol and many other substances have a maximum value for their dielectric constants at certain temperatures. This makes generalisations such as those of Abegg (Abstr., 1897, ii, 240) who calculates the dielectric constant of water at the absolute zero as 372, very untrustworthy.

H. C.

Dielectric Properties of Liquid Mixtures, especially of Dilute Solutions. By James C. Philip (*Zeit. physikal. Chem.*, 1897, **24**, 18—38).—The dielectric constant was determined for a number of liquid mixtures, and the values calculated by the mixture rule, both Gladstone's and Lorenz's formulæ being employed with substitution of $\sqrt{\kappa}$ for the refractive index. In the case of mixtures of benzene with ethylic ether, and of chloroform with carbon bisulphide, the observed values agree fairly well with the calculated numbers, lying generally between those obtained from the two formulæ, but with a mixture of ether and chloroform no such agreement can occur, as the constant increases to a maximum greater than that of either constituent. In all these cases, the constants of the two liquids are not far removed, but in those cases where they differ considerably, such as ethylic alcohol with chloroform, ethylic ether, carbon bisulphide, or benzene, the calculated values, except at great dilutions, are too low, those obtained by the Lorenz formula being only about one-half the actual values, the Gladstone formula giving far better agreement and being subsequently employed. Dilute solutions were then examined, and it was found that for solutions of nitrobenzene in benzene the calculated and observed values agree fairly well, and the discrepancies are attributed to the formula. The dielectric constant of nitrobenzene, as calculated from that of the mixture, is hence approximately constant, but with solutions of alcohols in benzene and toluene this is no longer the case, the value of the dielectric constant of the alcohol falling as the dilution increases, until a final limiting value is reached, these values being respectively: methylic alcohol, 16; ethylic alcohol, 11; propylic alcohol, 8·5; and amylic alcohol, 6. The author considers it probable that these are the values corresponding with the simple molecules, the dielectric constants obtained from the pure liquids being those due to molecular aggregates. L. M. J.

Electrochemical Method of changing Alternating into Direct Currents. By Leo Graetz (*Ann. Phys. Chem.*, 1897, [ii], **62**, 323—327).—An electrolytic cell, one of the electrodes of which is composed of aluminium, causes a great decrease in the strength of any current sent through it when the aluminium electrode is the anode, and the separation of oxygen takes place on it, but leaves the current unaffected when the aluminium is the cathode. If through a series of such cells an alternating current is sent, and the number of cells is so chosen that the anode polarisation balances or is greater than the tension of the current, the positive portion of the current, for which the aluminium would act as anode, is checked and only the negative current passes. On this principle, a method of converting an alternating current into a direct current is based. H. C.

Molecular Conductivity of Salts in Dilute Solution. By P. Joubin (*Compt. rend.*, 1897, **124**, 228—229).—The author supports Bouty's view that the molecular conductivity of certain salts is the same for infinite dilution, by showing, in the case of potassium chloride, that the quantity of electricity which is transferred by one molecule through the solution is that which is induced by the uniform field in which it is placed. H. C.

The Copper Voltameter. By Fritz Foerster (*Zeit. Elektrochem.*, 1897, **3**, 479—482 and 493—497).—The author discusses the errors of the copper voltameter and the methods of avoiding them, in the light of his previous experiments on the electrolysis of copper sulphate solutions (Foerster and Seidel, Abstr., 1897, ii, 241). The use of a concentrated solution of copper sulphate is necessary in order to prevent the deposition of the copper in a powdery form; it has the disadvantage that it increases the concentration which may be reached by the cuprous ions, but the solution never becomes saturated with the latter owing to their oxidation by the air. For this reason, the quantity of copper deposited when the solution is exposed to air is too small, especially with smaller current densities. This action of the atmospheric oxygen explains the fact that a copper plate partially immersed in an acidified solution of copper sulphate is most strongly acted on at the surface of the liquid. The addition of sulphuric acid to the copper sulphate solution diminishes the concentration of the cuprous ions to some extent, it is of more importance, however, in preventing the separation of cuprous oxide which takes place in neutral solutions owing to the hydrolysis of cuprous sulphate. The deposition of cuprous oxide not only increases the weight of the deposit on the cathode, but produces inequalities in its conductivity which give rise to the formation of cuprous ions where the current density is smallest. Since the presence of the acid diminishes the solubility of copper sulphate, a saturated solution of the latter cannot be used, as this would lead to deposition of the salt on the anode, entailing a large increase in resistance. A suitable solution is one containing 125 grams of $CuSO_4 + 5H_2O$, and 50 grams of H_2SO_4 per litre. In presence of air, the strongly acid solution dissolves no more copper than one containing little acid. Thus a normal solution of copper sulphate, which was also normal with respect to sulphuric acid, dissolved 17 milligrams of copper, whilst a solution containing 1/1000 of an equivalent of sulphuric acid dissolved, under the same circumstances, 15 milligrams.

In order to measure very small currents, a closed voltameter is used with a solution containing 1/10 or 1/20 gram equivalent of copper sulphate, and 1 gram equivalent of sulphuric acid, a slow current of purified hydrogen being passed through the solution during the experiment. The quantity of cuprous ions which can be formed under these circumstances is very small, and their conversion into cupric ions, at the anodes, is prevented almost completely by enveloping the latter in parchment paper. By comparison with a silver voltameter, it was found that the error in the quantity of copper deposited did not exceed a fraction of a milligram, even with a current density of 0·025 ampère per sq. dm.

The maximum current density with which an adherent deposit of copper can be obtained is higher the greater the concentration of the copper sulphate and the more thoroughly it is stirred so as to avoid local dilution near the cathode. With a solution of copper sulphate and sulphuric acid, both of normal strength, 2 ampères per sq. dm. may be safely employed.

The author finally discusses the possibility of using the loss of weight of the anode as a measure of the current, and concludes that no advantage would be obtained by so doing. T. E.

Electrolysis of Alkali Bromides and Fluorides. By Heinrich Pauli (*Zeit. Elektrochem.*, 1897, 3, 474—478).—The author has extended Oettel's work (Abstr, 1896, ii, 517) on the electrolysis of aqueous solutions of chlorides to solutions of potassium bromide; the results are very similar to those obtained with potassium chloride, except that the yield of potassium bromate is less than that of chlorate under the same circumstances, owing to the fact that the bromate is reduced by nascent hydrogen, even in alkaline solution, and that with the bromide, it is not possible to entirely avoid the formation of hypobromite.

Solutions of potassium fluoride, when electrolysed under various conditions, yield no evidence of the formation of any oxygen compound of fluorine; ozone is, however, always formed in considerable quantity. T. E.

Influence of Time on the Process occurring at the Cathode in the Electrolysis of Solutions of Copper Sulphate. By CARL ULLMANN (*Zeit. Elektrochem.*, 1897, 3, 516—521).—The solutions were placed in a cylindrical cell the horizontal end faces of which consisted of copper plates which served as electrodes, a constant current was maintained, and the liquid disturbed as little as possible. When the current is allowed to pass through the cell, the E. M. F. remains fairly constant for a time, t, during which the copper is deposited in the compact form; the E. M. F. then rises suddenly and considerably, the deposit taking the form of a loose brown or black powder; and finally hydrogen gas is evolved, which disturbs the solution, causing the E. M. F. to diminish. The time, t, during which compact copper is deposited depends on the current density, D, and on the concentration of the solution, m, the relation $D\sqrt{t}/m =$ constant, representing the author's experimental results with close approximation. Previous authors have found that for each concentration there is a limiting current density above which no coherent deposit can be obtained, but the author concludes that these observations are merely due to the fact that the time during which a coherent deposit is formed is too short to be observed. For example, Foerster and Seidel (Abstr., 1897, ii, 243) found that in a 0·01 normal solution of copper sulphate a black deposit was obtained with 0·4 ampère per sq. dm., even though the solution was stirred; under these conditions, the author calculates that a coherent deposit would be obtained for 0·6 second in an undisturbed solution, so that, in order that the coherent deposit should be obtained permanently, the stirring should suffice to renew the layer of solution adjacent to the cathode at least once in 0·6 second. T. E.

Electrolysis of Mixtures. By ANTON SCHRADER (*Zeit. Elektrochem.*, 1897, 3, 498—505).—The distribution of the current between two salts in a solution may, as Hittorf showed, be determined by means of migration experiments. Calling x the ratio in which the current is divided between the two salts, we have $x = Z_1n_2/Z_2n_1$, where Z_1 and Z_2 are the increments in the concentrations of the anions at the anode (in equivalents) and n_1 and n_2 their migration constants. With potassium iodide and chloride, the ratio of the concentrations of iodine and chlorine at the anode is hardly changed by the electrolysis (a result already obtained by Hittorf), so that, since $n_1 = n_2$ in this case, the current is divided between the salts very nearly in the ratio of their concentrations.

In sufficiently dilute solutions the specific conductivity k is given by the equation $k = N_1a_1\lambda_1 + N_2a_2\lambda_2$, where N_1 and N_2 are the concentrations of the salts in gram equivalents per litre, a_1 and a_2 their dissociation coefficients in the mixture, and λ_1 and λ_2 their molecular conductivities at infinite dilution. Further, the current is divided between the salts in proportion to the number of ions and their mobilities, so that $x = N_1a_1\lambda_1/N_2a_2\lambda_2$. By means of these two equations and the values of x, it is therefore possible to calculate the dissociation coefficients of the salts in the mixture. Supposing the solutions to be made up by bringing together equal volumes of the solutions of the single salts, the dissociation after mixing is less than before. In the following table, the index 1 refers to potassium iodide.

N_1.	N_2.	N_1/N_2.	x.	$10^8\ k$.	After mixing.		Before mixing.	
					a_1.	a_2.	a_1.	a_2.
0·02595	0·02571	1·009	0·997	53·5	0·843	0·854	0·903	0·888
0·03442	0·04748	0·725	0·704	86·6	0·852	0·877	0·891	0·860
0·03074	0·06176	0·498	0·500	95·3	0·847	0·843	0·896	0·854
0·01992	0·03720	0·535	0·486	59·8	0·806	0·886	0·911	0·874

Mixtures of copper sulphate and sulphuric acid were examined in the same way; the following table contains the results obtained. The index 1 here refers to sulphuric acid.

N_1.	N_2.	x.	$10^8\ k$.	After mixing.		Before mixing.	
				a_1.	a_2.	a_1.	a_2.
0·02753	0·06618	1·755	79·5	0·526	0·396	0·577	0·293
0·05297	0·12607	1·351	159	0·493	0·481	0·575	0·281
0·07217	0·07135	4·565	165·5	0·537	0·379	0·572	0·291
0·13753	0·24899	1·440	362	0·444	0·542	0·565	0·252
0·19605	0·34673	0·920	502	0·351	0·686	0·557	0·251
0·18043	0·14830	2·371	391	0·435	0·711	0·559	0·270

The interesting case of a mixture of acetic acid and silver acetate could not be examined, because the migration constant for acetic acid is not constant in solutions of a concentration with which it would be possible to work. The following values were obtained, v being the volume, in litres, in which a gram-molecule is dissolved, and n the migration constant for the anion.

v	1·267	1·357	1·703	2·077	2·789	3·988
n	0·362	0·307	0·241	0·212	0·182	0·169

The limiting value for infinite dilution should be 0·119.

From the values of x given above, it is possible to calculate the quantity of hydrogen which should separate at the cathode when a solution of sulphuric acid and copper sulphate is electrolysed; a part of this, however, is supposed to precipitate copper from the solution. The ratio, σ, between the latter part and the whole quantity which should separate out is a function of the current density. The author's results may be reproduced by an equation of the form $\sigma = A/(D + B)$, where A and B are constants and D is the current density. At a certain limiting current density, σ becomes equal to unity, and at lower current densities no hydrogen separates.

T. E.

The Electro-chemical Equivalent of Carbon. By ALFRED COEHN (*Zeit. Elektrochem.*, 1897, 3, 424—425).—When carbon is employed as the anode in the electrolysis of liquids which evolve oxygen, it is not only mechanically disintegrated but also chemically acted on, the nature of the latter action appearing to depend on the electrolyte employed. For example, a current of 0·12 ampère is passed through six cells furnished with anodes of pure carbon and cathodes of platinum, and containing sulphuric acid diluted with 1, 10, 20, 50, 100, and 500 volumes of water; after 10 hours, the most concentrated solution is colourless, the most dilute dark brown, and the others of intermediate shades of colour. At higher temperatures, there is less mechanical disintegration and the electrolyte is more strongly coloured than at lower temperatures. The mechanical disintegration is inconsiderable at 100° in a solution containing equal volumes of water and concentrated sulphuric acid. A determination of the loss of weight of a carefully purified carbon anode under these circumstances gave the number 3·5 as the electrochemical equivalent of carbon, but some mechanical loss had occurred. A further series of determinations were made at the ordinary temperature with sulphuric acid diluted with from 10 to 500 times its volume of water, the particles of carbon lost mechanically being collected and their weight subtracted from the total loss of weight of the anodes. The electrochemical equivalent thus determined varied from 2·7 to 3·0. The number obtained is thus independent of the concentration or temperature of the acid, notwithstanding the apparent difference in the action. T. E.

Volatility of Fluorine Compounds. By LOUIS HENRY (*Rec. Trav. Chim.*, 1897, 16, 218—225).—The introduction of fluorine in the place of part of the hydrogen of a hydrocarbon appears to have but little influence on the boiling point of the compounds, this being raised, as a rule, some 5° by the substitution of 1 atom of fluorine for 1 of hydrogen. Benzene boils at 80°, phenylic fluoride at 84—85°; toluene boils at 111° and monofluorotoluene at 116°. If, however, fluorine is introduced into a molecule which already contains several halogen atoms, the boiling point is lowered, notwithstanding that the molecular weight is increased.

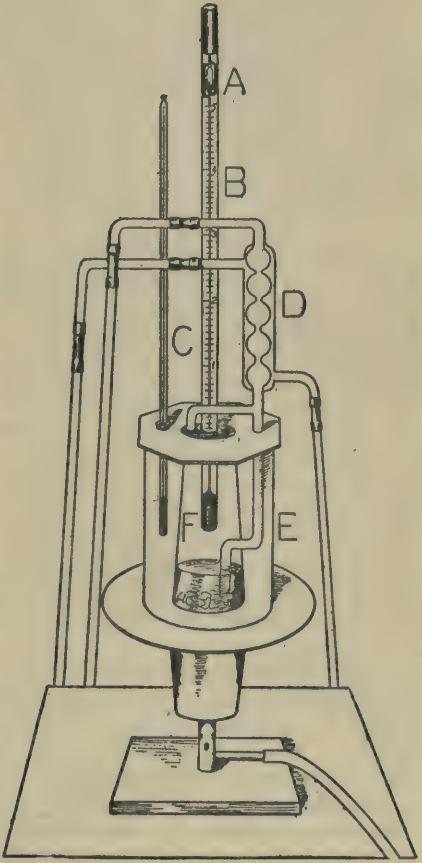
$CHCl_3$	boils at	61°	CH_2Cl_2	boils at	41°
$CFCl_3$	,,	24°	$CHFCl_2$	,,	14·5°
CH_2ClBr	,,	68°	$CHCl_2\cdot COCl$	,,	107°
$CHFClBr$	,,	38°	$CFCl_2\cdot COCl$	,,	75°
$CHCl_2\cdot COOH$	,,	190°	$CHCl_2\cdot COOEt$	,,	157°
$CFCl_2\cdot COOH$	,,	162·5°	$CFCl_2\cdot COOEt$	,,	130°
$CHCl_2\cdot CONH_2$	,,	233°			
$CFCl_2\cdot CONH_2$	,,	215°			

Also the substitution of fluorine for hydrogen in the aldehydic group –COH causes a lowering of the boiling point.

$CH_3\cdot COH$	boils at	21°	$C_2H_5\cdot COH$	boils at	49°
$CH_3\cdot COF$	,,	20·8°	$C_2H_5\cdot COF$	,,	44°
$C_5H_6\cdot COH$	boils at	179°			
$C_5H_6\cdot COF$	,,	154°			

The author quotes numerous examples to show that the introduction of chlorine, in place of hydrogen, into compounds which already have several halogen atoms in the molecule, always increases the boiling point; a similar effect is also noticed when chlorine is substituted for the hydrogen of the aldehyde group. J. J. S.

Modified Form of the Ebullioscope. By HARVEY W. WILEY (*J. Amer. Chem. Soc.*, 1896, 18, 1063—1067).—The flask F is closed by a rubber stopper carrying the large thermometer B and a tube leading to the condenser D. The vapours which are given off during ebullition are condensed in D and return to the flask through the tube, as indicated in the figure, entering the flask below the surface of the liquid therein. The flask is heated by a gas lamp and is placed on a circular disc of asbestos in such a way as to entirely cover the hole in the centre of the asbestos disc, which is a little smaller than the bottom of the flask. The whole apparatus is protected from external influences of temperature by the glass cylinder E, which rests on the asbestos disc below and is covered with a detachable, stiff rubber cloth disc above. The thermometer C indicates the temperature of the ambient air between F and E. The reading of the thermometer B should always be made at a given temperature of the ambient air, as indicated by C. H. C.



New Method of Determining the Vapour Pressures of Solutions. By E. B. H. WADE (*Proc. Roy. Soc.*, 1897, 61, 285—287).—The apparatus employed in this research was, in conception, similar to that described by Sakurai (Trans., 1892, 986), except that it was in duplicate, a divided steam supply passing through two U-tubes placed in parallel. The pressure on the contents of the two U-tubes, being the same, could be adjusted to any convenient value, and the method of thermometry being differential, the difference only of the boiling points of pure water and of the solution in their respective U-tubes was recorded. The substances examined were the chlorides and bromides of potassium and sodium, and chlorides of lithium, calcium, and strontium. The results were compared with those calculated from the theory of Arrhenius; the discrepancy observed always exceeds the experimental error, except in the case of potassium chloride, and is particularly great in the case of calcium chloride. H. C.

Vapour Pressure of a Substance compressed by a Gas that it Dissolves. By A. Ponsot (*Compt. rend.*, 1896, **123**, 648—650).—From a mathematical consideration of the case of a solvent which is under the pressure of a gas that it dissolves, the author concludes that the gas or the dissolved substance in the liquid decreases the vapour pressure of the solvent, whilst, at the same time, the gas in the mixed vapour increases the vapour pressure of the solvent. The total effect is, therefore, that the vapour pressure increases if the gas is denser in the gaseous mixture than in the liquid mixture, and it decreases if the reverse is the case. H. C.

Latent Heats of Vaporisation, and the Law of Van der Waals. By Georges Darzens (*Compt. rend.*, 1897, **124**, 610—612).—According to Van der Waals, $M\lambda/T_c = f(T/T_c)$, where M is the molecular weight, λ the latent heat of vaporisation at the absolute temperature T, T_c is the absolute critical temperature and f is a function which is the same for all substances. The author transforms this into $M\lambda/T = F(T/T_c)$, in which the first term is independent of the critical temperature, and then plots values of $M\lambda/T$ against those of T/T_c for different substances. All the curves $y = F(x)$ are of similar character; for low values of $x = T/T_c$ they are slightly concave towards the y axis, then at about $T/T_c = 0{\cdot}750$ there is a point of inflexion, and the convex side is turned towards the y axis. No exact coincidence is obtained, the differences becoming more marked as the values of T/T_c decrease, and being probably partly due to errors in the determination of T_c, and to molecular association at low temperatures. H. C.

Preliminary Experiments in the Determination of Vapour Density at Extremely High Temperatures. By Victor Meyer and Max von Recklinghausen (*Ber.*, 1897, **30**, 1926—1935).—The authors describe in detail the observations they have made in attempting to prepare a form of apparatus suitable for the determination of vapour densities at temperatures above 2000°. The material which resists most successfully the influence of these elevated temperatures is a commercial magnesia prepared from a magnesite occurring at Veitsch in Steyermark; this crude magnesia, on analysis, gave

MgO.	CaO.	MnO.	Fe_2O_3.	Al_2O_3.	SiO_2.
88·2	0·9	0·6	7·1	0·8	2·4

When this substance is powdered, and converted into a paste with a cold, saturated solution of magnesium chloride, it becomes quite hard at the ordinary temperature after an interval of 1—2 days, the same effect being produced by exposure to a temperature of 120—150° during 1 hour. The oxychloride formed is completely decomposed and all the chlorine eliminated in the subsequent ignition.

Directions are given in the paper for preparing suitable vessels from this material, but unfortunately, although vapour density flasks capable of resisting temperatures far above the melting point of platinum were obtained, it was not found possible to render them absolutely impervious to gases, although small pieces were burnt absolutely gas-tight. It is, however, hoped that this end may shortly be attained. M. O. F.

Velocity of Solidification. By JACOB FRIEDLÄNDER and GUSTAV TAMMANN (*Zeit. physikal. Chem.*, 1897, **24**, 152—159).—Tammann has previously shown (Abstr., 1897, ii, 444) that the velocity of solidification increases with the overcooling until a constant value is reached. The cause of the initial increase is probably due to differences in the disposition of the crystals and imperfect purity of the liquid, so that at first, with slight overcooling, the crystals are purer than the mother liquor, but when the maximum value is reached, solidification causes no change in concentration. Experiments were made with benzophenone, azobenzene, hydrocinnamic acid, diphenylamine, salol, benzoic anhydride and guaiacol, and curves showing the dependence of velocity on overcooling are given. For salol, the velocity is very small at all degrees of overcooling, but for all the other compounds it rapidly increases, and reaches a final constant value which differs very greatly for the different compounds, varying as it does from 570 for azobenzene to 6 for guaiacol. L. M. J.

Method Pursued in Accurate Cryoscopic Determinations. By FRANÇOIS M. RAOULT (*Compt. rend.*, 1897, **124**, 851—854).—The author details the precautions which must be taken in carrying out accurate cryoscopic measurements (compare Abstr., 1896, ii, 11, 88, and 362). He claims to have attained to an accuracy of 0·0005° in this work. H. C.

Elevation of the Freezing Point in Benzene Solutions. By RÓZSA MIHÁLY (*Zeit. physikal. Chem.*, 1897, **24**, 13—17).—When water is added to a solution of ethylic alcohol in benzene, the freezing point is raised, the elevation continuing until the water added reaches a very high percentage. Experiments were made with a solution containing originally about 23 per cent. of alcohol, with freezing point 1·74°, which leads to the value 4·83 for the association factor of the alcohol. A curve gives the effect produced on the freezing point by adding water, and exhibits a sharp bend at the point corresponding with $3C_2H_5\cdot OH,H_2O$, but owing to the high association factor of the alcohol, the formation of this compound should not cause an elevation of the freezing point. Calculations of the freezing point on the assumption that the compound $9C_2H_5\cdot OH,3H_2O$ is formed are, however, found to agree satisfactorily with the observed numbers. Similar effects are obtained on adding water to solutions of phenol and acetic acid in benzene. L. M. J.

Surface Tension of Water and of Dilute Aqueous Solutions. By N. ERNEST DORSEY (*Chem. News*, 1897, **76**, 22).—The author has applied the method of ripples; these being produced by a fork, at a frequency of 62·87 double vibrations per second, on the water or solutions in a porcelain tray 1 × 12 × 14 inches; the wave-length was measured with a telescope, and the waves observed by Foucault's method. The water was distilled from chromic acid and alkaline permanganate, and the solutions varied in concentration from 0·05 normal to normal. The value found for water is $T = 75·98$ dynes per c.c. at 0°, and the values for dilute aqueous solution are linear functions of the concentration, and may be written $T_8 = T_w + kC$, where T_8 = surface tension of the solution, T_w surface tension of the water at the same temperature, k a constant, and C the concentration in gram-molecules per litre. The author's values for k are as follows: NaCl, 1·53; KCl, 2·23; $\frac{1}{2}Na_2CO_3$, 2·00; $\frac{1}{2}K_2CO_3$, 1·77; $ZnSO_4$, 1·86. D. A. L.

Absorption of Nitrous Oxide in Aqueous Solutions of various Dissociated Compounds. By WALTHER ROTH (*Zeit. physikal. Chem.*, 1897, **24**, 114—151).—From Gordon's experiments (Abstr., 1896, ii, 154) on the solubility of nitrous oxide in various solutions, an empirical equation was obtained for the lowering of the absorption coefficient, namely, $a - a_1/M^{\frac{2}{3}} =$ (constant), where M is the number of gram-molecules of dissolved substance in unit volume of solution, that is, the lowering of the absorption coefficient is proportional to the number of salt molecules per square centimetre. As this law was not deduced theoretically, the author examined the conditions of equilibrium in the system and infers that the molecular concentration of the gas must be the same in pure water as in dilute solutions of a salt or indifferent compound, the assumptions involved being that there is no chemical action and that the molecular weight of the gas remains unaltered. In order to test the validity of this deduction, the author determined the absorption coefficient of nitrous oxide in pure water and in solutions of carbamide, glycerol, oxalic acid, phosphoric acid, and sodium chloride at various concentrations and at numerous temperatures varying from 4° to 25°. From the experimental results, an expression for the absorption coefficient of the form $a - bt - ct^2$ is calculated and the values subsequently employed are derived from this expression. These and the density of the solutions give the ratio c/c_1 of the molecular concentrations of the gas in water and the solution. For carbamide, this ratio is equal to unity, the difference being irregular and only reaching 1 per cent., so that the law is valid. For glycerol, however, the ratio increases with the concentration and varies with the temperature, but as the cryoscopic behaviour of glycerol is also abnormal, the author considers it probable that, in more dilute solutions, the law would be obeyed. For oxalic acid solutions up to 3·7 per cent., the law is also valid, but for phosphoric acid and sodium chloride, it certainly does not hold good, even when the solutions are extremely dilute. The expression $a - a_1/M^{\frac{2}{3}}$ in these cases gives a constant, but with the glycerol solutions greater constancy is obtained for the expression $a - a_1/M$. L. M. J.

(NOTE.)—It may be noticed that the decrease of the absorption coefficient of the nitrous oxide is not in accord with Winkler's generalisation (Abstr., 1892, 556). L. M. J.

Decomposition of Salts by Water. By JOSEPH GUINCHANT (*Bull. Soc. Chim.*, 1896, [iii], **15**, 555—560).—Salts of a strong acid and a weak base are decomposed by water, a basic salt being precipitated, and the solution containing free acid and a residual salt, which may be either the normal or the basic salt. In the case of mercuric sulphate, if a complete decomposition of the normal salt into free acid and basic sulphate occurred under the influence of water, dissolution of the basic sulphate in dilute sulphuric acid, in which it might be expected to dissolve unchanged, would cause a depression of the freezing point of the acid solution. If the normal salt is only partially decomposed by water, and unchanged normal salt remains in the solution, dissolution of the basic sulphate in dilute sulphuric acid, with a portion of which it would combine, would raise the freezing point of the acid. The one effect actually produced is the one last mentioned, and as, moreover, the cryoscopic behaviour of the normal sulphate in dilute sulphuric acid is in keeping with the view that the mercuric sulphate dissolves unchanged, it appears that the decomposition of this salt by water is only a partial one. H. C.

Dissociation in Solutions. By WALTER S. HENDRIXSON (*Zeit. anorg. Chem.*, 1896, **13**, 73—80).—The distribution of a solid between two non-miscible solvents was studied, in the case of benzoic acid, with mixtures of water and benzene, and of water and chloroform, and in the case of salicylic acid with the same solvents. The author, applying Nernst's law (Abstr., 1891, 1148), obtains the dissociation coefficient of the double molecules into simple molecules in benzene and chloroform, from which the heat of dissociation of the double molecules can be calculated. Although the results are only approximate, it appears that the heat of dissociation is in both cases fairly large.

H. C.

Velocity of Oxidation of Gases by Liquids. By VICTOR MEYER and ERNST SAAM (*Ber.*, 1897, **30**, 1935—1940).—The authors show that the absorption of hydrogen, carbonic oxide, and methane by solutions of potassium permanganate proceeds with uniform speed. The hydrocarbon is oxidised much less rapidly than hydrogen, and the speed of absorption diminishes in ascending the homologous series, propane and isobutane scarcely undergoing perceptible oxidation when agitated with a 5 per cent. solution of potassium permanganate during an hour.

Experiments were also performed with silver nitrate and silver oxide, but the results obtained with hydrogen exhibited less uniformity than in the case of potassium permanganate. M. O. F.

Chemical Equilibrium between Ethylic Alcohol and Sulphuric Acid. By ARTHUR ZAITSCHEK (*Zeit. physikal. Chem.*, 1897, **24**, 1—12).—By the mutual action of sulphuric acid and ethylic alcohol, or of the equivalent quantities of water and ethylic hydrogen sulphate, the same final state is reached, the action being reversible. The author has investigated, in solutions of various dilutions, the equilibrium constant for the bimolecular reaction $C_2H_5{\cdot}OH + H_2SO_4 \rightleftarrows C_2H_5{\cdot}HSO_4 + H_2O$. The results do not give a constant value for k if the sulphuric acid be calculated as H_2SO_4, but satisfactory constancy is obtained if it be calculated for H_6SO_6, so that the author considers the sulphuric acid in aqueous solution to be present as the ortho-acid, and no evidence is obtained of the existence of any higher hydrates. This apparently leads to the equation $H_6SO_6 + C_2H_6\cdot OH \rightleftarrows C_2H_5\cdot HSO_4 + 3H_2O$, that is, the decomposition of the sulphate is quadrimolecular, but the author considers the reaction to be really bimolecular, the sulphuric acid produced immediately forming the ortho-acid. In the presence of excess of acid, the mass law apparently does not hold, owing to the too rapid increase of velocity of the sulphate formation. No evidence of the formation of hydrates of either ethylic alcohol or of ethylic hydrogen sulphate was obtained. L. M. J.

Velocity of formation of Azo-dyes. II. By HEINRICH GOLDSCHMIDT and FRITZ BUSS (*Ber.*, 1897, **30**, 2075—2093).—The equation given in the former paper (compare Goldschmidt and Merz, Abstr., 1897, i, 278) represents the velocity of reaction between equivalent quantities of dimethylaniline hydrochloride and diazobenzenesulphonic acid in the presence of excess of hydrochloric acid ; it also applies to diethylaniline, but in this case the velocity is somewhat smaller. By using salts of other acids, such, for instance, as trichloracetic acid, the value of the constant becomes larger, although the dissociation constant of the acid is smaller. By the use of a weaker acid, such as acetic, chloracetic, or dichloracetic acid, a further complication arises, since the dissociation does not remain constant, but varies owing to the hydrolysis of the salt by the excess of acid present ; in order to avoid this, a large excess of the weaker acid is necessary, but since the excess of acid has an influence on the velocity of reaction, the constants derived from the equations are not the true constants of velocity ; in the case of strong acids, the product must be multiplied by the hydrolytic constant of the acid, and with weaker acids it must be multiplied by the hydrolytic constant and divided by the affinity constant. In this way, then, the affinity constants of the acids can also be determined, and the authors' figures in this respect correspond closely with those given by Ostwald. J. F. T.

An Improved Pyknometer. By EDWARD R. SQUIBB (*J. Amer. Chem. Soc.*, 1897, **19**, 111—112).—The author has devised a specific gravity bottle which may be used at any temperature between 0° and 25°. The construction is that of the ordinary specific gravity bottle, but the stopper consists of a graduated stem with a safety reservoir at the top, the stem being ground into the bottle. The reservoir is closed by a stopper. L. DE K.

Inorganic Chemistry.

Critical Constants of Hydrogen Chloride, Phosphide, and Sulphide. By ANATOLE LEDUC and P. SACERDOTE (*Compt. rend.*, 1897, **125**, 397—398).—The trihydrogen phosphide was prepared from a solution of cuprosodiphosphonium chloride, the hydrogen sulphide by the action of hydrochloric acid on antimony sulphide. The following results were obtained :

	Critical temperature.	Critical pressure.
Hydrogen chloride	52°	83 atmos.
Hydrogen phosphide	52·8	64 ,,
Hydrogen sulphide	100	90 ,,

The results agree somewhat closely with those obtained by Dewar in the case of the chloride and sulphide, and also agree fairly well, so far as temperature is concerned, with the results of Vincent and Chappuis for the chloride, and of Olzewski for the sulphide, although there are considerable differences in the pressures. C. H. B

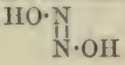
Hypoiodous Acid and Hypoiodites. By ROBERT L. TAYLOR (*Chem. News*, 1897, 76, 17—20, 27—29).—Schönbein found that ammonia decolorised an aqueous solution of iodine, yielding a liquid that bleached indigo and gave a blue colour with starch ; the author confirms this statement and shows that similar solutions may be produced with potash, soda, lime-water, and barium hydroxide. The bleaching strength of such solutions, ascertained by titration with standard indigo-carmine, corresponds with the amount of iodine present, which amounts to about 1 per 5000 ; stronger solutions may, however, be prepared by using some precipitated iodine with the iodine water. These solutions decompose in a few hours at ordinary temperatures, and in a few minutes when boiled, with the production of the iodide and iodate. Acids decompose them with the liberation first of hydriodic and hypoiodous or iodic acids, which at once react so that free iodine and water are obtained. With silver nitrate, the solutions yield a dark buff precipitate of the hypoiodite mixed with hydroxide and iodide ; with a cobalt solution, a black precipitate on standing ; with a manganous salt, a dark brown precipitate immediately ; with lead salts, a precipitate containing brown lead peroxide, and with hydrogen peroxide, an immediate and copious evolution of oxygen. The author has also obtained such solutions by Lunge and Schoch's method of triturating iodine, lime, and water together, and attributes their failure to delay in testing these solutions or to their having been heated. Moreover, solutions obtained by shaking mercuric oxide with iodine water are observed to have a feeble bleaching action, and on the addition of a drop of alkali, immediately become as active as the hypoiodite solutions just referred to, which they then resemble in all other respects. These solutions of free hypoiodous acid can be also made stronger if iodine is suspended in the iodine water ; they can also be obtained by shaking iodine water with silver salts ; in the latter case, however, they are very unstable, whilst when made by the use of mercuric oxide they are more stable than the hypoiodite solutions. The free acid decomposes into hydriodic and iodic acids, which react and yield free iodine and water ; it does not turn starch blue until after exposure to the air, but with silver nitrate it gives a precipitate consisting of the iodide, and iodate after boiling.

D. A. L.

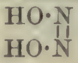
Formation of Active Oxygen. By W. P. Jorissen (*Ber.*, 1897, 30, 1951—1953. Compare Engler and Wild, Abstr., 1897, ii, 402).—The author considers that the mechanism of oxidation by oxygen gas, in which a quantity of active oxygen equal to that concerned in the primary oxidation is produced, is not necessarily the same in all cases. The primary formation of a peroxide frequently affords the most simple explanation; whilst, on the other hand, cases may arise accompanied by electrical phenomena or by anomalies in the velocity of change which are best explained by van't Hoff's assumption of the dissociation of the oxygen molecule into oppositely charged ions (compare Jorissen Abstr., 1897, ii, 253 and 487). T. E.

Reduction of Concentrated Sulphuric Acid by Copper. By Charles Baskerville (*J. Amer. Chem. Soc.*, 1896, 18, 942—947. Compare Abstr., 1896, ii, 474).—The author has repeated some of his former experiments, and now states that concentrated sulphuric acid (1·84) is reduced by copper when air is absent and at temperatures far below 86°, in fact, at ordinary atmospheric temperatures, with the formation of copper sulphate, cuprous sulphide, and sulphurous anhydride. The author also adheres to his previous statement that copper reduces concentrated sulphuric acid at 0° (compare Andrews, Abstr., 1897, ii, 22). J. J. S.

Conversion of Nitrosohydroxylamines into Hyponitrous Acid. By Arthur R. Hantzsch (*Ber.*, 1897, 30, 2356—2358).—Hyponitrous acid is formed by the direct action of nitrous acid on hydroxylamine in solution in methylic alcohol. It is also produced when dimethylnitrosohydroxycarbamide, $NMe_2\cdot CO\cdot N(OH)\cdot NO$, which may also be regarded as isonitraminecarbamide, $NMe_2\cdot CO\cdot N_2O_2H$, is treated with alkalis at 0°. From this it would appear probable that nitrosohydroxylamine and hyponitrous acid are tautomeric. The parallel formation of nitramide, $N_2O_2H_2$, from potassium nitrocarbamate, $KO\cdot CO\cdot N_2O_2K$, points to the probability that nitramide and hyponitrous acid are in reality stereoisomeric diazohydrates,



$$\begin{array}{l} HO\cdot N \\ \quad\;\; \| \\ \quad\;\; N\cdot OH \end{array}$$



$$\begin{array}{l} HO\cdot N \\ \quad\;\; \| \\ HO\cdot N \end{array}$$

A. H.

Action of Arsenious Acid on Metallic Oxides, Oxychlorides, and Amidochlorides. By C. Reichard (*Ber.*, 1897, 30, 1913—1916. Compare Abstr., 1894, ii, 350).—The author has studied the behaviour of the oxides of copper, mercury, silver, nickel, cobalt, tin, chromium, manganese, and bismuth, copper oxychlorides, and the mercury ammoniochlorides towards solutions of arsenious oxide in water, soda, and ammonia. The observations, mainly qualitative, are embodied in a lengthy table, which does not admit of compression. M. O. F.

Characteristics of Flames. By Nicolae Teclu (*J. pr. Chem.* 1897, 56, 178—180).—Hirn (*Ann. chim. phys.*, 30, 319) has stated his inability to demonstrate optically the presence of particles of carbon in an ordinary gas flame, and concluded that at a high temperature these particles are transparent.

The author finds that when the shadows of a yellow and blue gas flame, a candle flame, and the flame from a petroleum lamp are thrown on to a screen and photographed, no difference is noticed in the case of the two gas flames, but a slight darkening in the shadow of the candle flame is observed, and a very marked one in the case of the petroleum flame.

The difficulty in obtaining the shadow of the particles in an ordinary luminous gas flame is due to their exceeding fineness. If, however, twelve fish-tail burners are placed one behind the other and lit up by an electric lamp, the darkening in their shadow is very pronounced. This cannot be caused by gases or vapours, because a layer of gas of the same thickness as the twelve fish-tail burner flame gave no shadow at all. A. W. C.

Note by Editor.—Soret (*Phil. Mag.*, 1875, p. 50), and Burch (Abstr., 1885, 466) have incontestably proved that the flame of a candle contains solid particles.

Preparation and Properties of Potassium Percarbonate. By Arthur von Hansen (*Zeit. Elektrochem.*, 1897, 3, 445—448. See Constam and von Hansen, Abstr., 1897, ii, 550).—The influence of small variations of temperature on the yield of potassium percarbonate is not very marked, if the specific gravity of the solution of potassium carbonate surrounding the anode is not allowed to fall below 1·52. Under these circumstances, the temperature may rise as high as 0° without sensibly affecting the yield. If the concentration falls, however, even a little below saturation, the yield of solid percarbonate suffers considerably, owing to the great solubility of the salt in more dilute solutions of potassium carbonate. High current density at the anode is also essential; with 0·5 to 2 ampères per sq. dcm., the product contains from 25 to 55 per cent. of percarbonate, whilst with 30 to 60 ampères per sq. dcm. it contained 85 to 95 per cent. The best results are therefore obtained by allowing a saturated solution of potassium carbonate to flow slowly into the anode compartment of the electrolytic cell at the bottom; the solution which has already undergone electrolysis, and in which the solid percarbonate remains suspended, floats on this and is slowly expelled from the cell, carrying with it the percarbonate; this is collected and dried on a porous plate in a current of dry air, which is finally warmed to about 40°. The yield of 87 to 93 per cent. salt is from 2·2 to 2·4 grams per ampère hour.

The salt is more stable than was at first supposed. When dry, it is only slowly decomposed at 100°, a temperature of 200° to 300° being required for its rapid decomposition. An aqueous solution decomposes slowly at the ordinary temperature, but rapidly at 45°. Completely dry potassium percarbonate may be preserved without undergoing appreciable change, but when moist it suffers somewhat rapid decomposition. It is very little soluble in alcohol, but extremely soluble in water, from which it cannot be recrystallised. It may, however, be purified by digestion at $-5°$ to $-10°$ with a concentrated solution of caustic potash; this dissolves the bicarbonate, and the remaining solid, after filtration and washing with alcohol, contains 95 to 99 per cent. of potassium percarbonate. T. E.

Influence exercised by Ferric Oxide on the Formation of Sodium Sulphate from Sulphurous Anhydride, Air, and Sodium Chloride. By JEAN KRUTWIG (*Rec. Trav. Chim.*, 1897, **16**, 173—180).—Iron pyrites was finely divided and thoroughly dried, and then mixed with finely divided common salt which had previously been heated to redness. The mixture, placed in a porcelain boat and introduced into a combustion tube, was heated in a Glaser furnace, while dried air was passed slowly through the tube; the air was then made to traverse tubes filled with glass wool, and finally through a tube containing a solution of potassium iodide. The first experiments were made with a mixture of pyrites and sodium chloride only; in later experiments, ferric oxide was introduced. The conclusions arrived at are: (1) ferric oxide acts as an oxygen carrier; (2) the conversion of sodium chloride into sodium sulphate depends on the amount of ferric oxide present; (3) the temperature at which the operation is carried on has a great influence on the results. J. J. S.

Silver Alloys. By GILBERT J. FOWLER and PHILIP J. HARTOG (*J. Soc. Chem. Ind.*, 1895, **14**, 243—245).—The authors have attempted to prepare silver alloys which, whilst possessing the whiteness of silver, should not be liable to tarnish. The following alloys were obtained by fusing their constituents and then quickly cooling. Silver-zinc alloys:—1—Silver 95, zinc 5 per cent.; 2—silver 93, zinc 7 per cent.; 3—silver 90 and zinc 10 per cent. Silver-nickel alloys:—1—Silver 95 and nickel 4 per cent.; 2—silver 90 and nickel 10 per cent. Silver-nickel-zinc alloy:—silver 90, nickel 5, and zinc 5 per cent. Silver-copper-zinc alloys: —1—Silver 75, copper 15, and zinc 10 per cent.; 2—silver 67·87, copper 5·17, and zinc 27·47 per cent. Silver-aluminium alloy:—Silver 90 and aluminium 10 per cent. Silver-tin alloy:—Silver 95 and tin 5 per cent. All these alloys tarnished readily, but it was found that the stain was more easily removed by rubbing with a chamois leather than in the case of pure silver.

The authors also tried to obtain suitable alloys by electrolytic deposition from solutions containing silver and zinc; silver, zinc, and copper; or silver and aluminium, but the results were not satisfactory. (Compare S. P. Thompson, *Proc. Roy. Soc.*, 1887, **42**, 387, and C. Winkler, this Journal, 1872, 1134). J. J. S.

Solubility of Calcium Sulphite in Water and in Sugar Solutions. By JULIUS WEISBERG (*Bull. Soc. Chim.*, 1896, [iii], **15**, 1247—1250).—The calcium sulphite used was prepared by the action of sulphurous anhydride on milk of lime, and throughout the experiments care was taken to avoid contact with air as far as possible.

At 18°, a litre of water dissolves 0·043 gram of calcium sulphite only; a litre of a 10 per cent. sugar solution dissolves 0·0825 gram, and a litre of a 30 per cent. sugar solution dissolves practically the same amount. The sulphite in solution oxidises rapidly, especially if the solutions are heated. C. H. B.

Stability of Phosphorescent Strontium Sulphide. By JOSÉ R. MOURELO (*Compt. rend.*, 1897, **125**, 462—464).—The various forms of phosphorescent strontium sulphide, when exposed to sunlight in presence of air, give off some hydrogen sulphide, and are more or less completely oxidised. The least stable variety is that prepared by the action of hydrogen sulphide on the carbonate, and the most stable is that prepared by the author's modification of Verneuil's method (Abstr., 1897, ii, 450—469); the latter, in fact, changes very slowly. Impurities, more especially alkali compounds, increase the stability in all cases, most probably because they cause incipient fusion, and the sulphide thus becomes covered with a kind of protective glaze. In all cases, the rate of oxidation is more rapid if the sulphide is powdered, but the phosphorescence is not affected by the oxidation, except in so far as the sulphide is converted into non-phosphorescent compounds.

C. H. B.

Compounds of Metallic Hydroxides with Iodine. By THEODORE RETTIE (*J. Amer. Chem. Soc.*, 1897, 19, 333—339).—If a solution of a magnesium salt is mixed with a supersaturated solution of iodine in aqueous potash, or if it is first mixed with a solution of iodine in potassium iodide, and then with a small quantity of aqueous potash, a dark, reddish-brown precipitate is formed containing magnesium hydroxide and iodine.

The author now states that this compound must be considered rather as a mixture, since the ratio between the iodine and magnesium varies from 2·1 to 6·3. On substituting zinc acetate for a magnesium salt, an iodised zinc hydroxide is obtained in which the ratio between iodine and zinc is fairly constant, varying from 2·4 to 2·9. Cadmium nitrate also gives a fairly stable precipitate. The iodine is, however, only in a weak state of combination, and is gradually removed by washing or drying. (Compare Walker and Kay, Abstr., 1897, ii, 261.)

L. DE K.

New Mode of Combination between Metals: Alloys of Cadmium with Silver and with Copper. By JEAN B. SENDERENS (*Bull. Soc. Chim.*, 1896, [iii], 15, 1241—1247).—When a bar of cadmium is placed in a neutral solution of silver sulphate, the quantity of cadmium sulphate that is formed is exactly equivalent to the silver precipitated, but the loss of weight of the bar is much greater than the weight of the cadmium dissolved. Further, if the precipitated silver is allowed to remain in contact with the cadmium, the loss of weight of the latter increases during a period of five months or more, and in one set of experiments the loss was more than six times as great as the calculated amount. There is no decomposition of the water, and no appreciable formation of cadmium oxide, provided that air is excluded. Cadmium sulphate solution has no action on cadmium. If freshly precipitated silver is brought in contact with cadmium in presence of cadmium sulphate solution, similar results are obtained, and this is true also when pure water is substituted for the solution of the salt. The cadmium removed from the mass of the metal seems to combine with the finely divided silver, forming an alloy, and since the action practically ceases when the alloy has a composition corresponding with the formula $AgCd_3$, it would seem that this is the limiting compound. The important point is, that the formation of this alloy is subsequent to, and not simultaneous with, the precipitation of the silver. Silver acetate behaves like the sulphate, but with silver nitrate, the precipitated silver adheres so firmly to the cadmium that investigation becomes almost impossible.

Copper sulphate, chloride, and acetate yield similar results, with the exception that the formation of the cadmium alloy is simultaneous with the precipitation of the copper.

The velocity of the reaction varies with the different salts, but precipitation is completed more quickly the more dilute the solution. No hydrogen is liberated. The ratio of the excess of cadmium removed to the calculated quantity is independent of the quantity of copper solution used, but varies with its concentration; it is greater the more dilute the solution. These facts may be due to the existence of several definite alloys of copper and cadmium, or to an influence of the concentration of the solution on the proportion of the copper that is converted into alloy; the latter seems more probable. Copper nitrate, like silver nitrate, does not lend itself to experiments of this kind.

Cadmium precipitates all the lead from dilute solutions of lead acetate, but there is no evidence of any formation of an alloy. With solutions of lead nitrate, or concentrated solutions of the acetate, the precipitated metal adheres strongly to the cadmium.

C. H. B.

Improvements in the Preparation of Metallic Alloys by Electrolysis. By JOHANN WALTER (*Zeit. Elektrochem.*, 1897, 3, 385—388).—In the electrolytic preparation of alloys, it is difficult to obtain them in a homogeneous condition. To overcome this difficulty, one of the metals may be employed as cathode in the molten condition, and during the electrolysis, it should be stirred continuously; the same result may be obtained by allowing it to flow through the electrolyte in a thin stream. Secondly, the one metal may be suspended in the bath from which the other is deposited on it, the temperature of the bath being regulated so that the alloy formed fuses and falls to the bottom, exposing a fresh surface. A third process consists in periodically adding small quantities of the more readily separable metal to the bath; the two metals are then deposited in thin, alternate layers. A number of possible modifications of each of these methods is mentioned, and as examples of their application, the following processes are described. An *alloy of sodium and lead* may be obtained by using lead as the cathode in a bath of fused sodium chloride. The molten lead is stirred by passing through it some indifferent gas such as nitrogen, or, better, some gas which combines with the chlorine evolved at the anode, for example, hydrogen, carbonic oxide, or methane. An *aluminium-tin alloy* can be prepared by allowing tin to flow over a channelled carbon cathode forming the bottom of a bath of fused aluminium sodium chloride.

Silicon bronze is obtained by the electrolysis of fused sodium silicate, the melting point of which is preferably depressed by admixture of other suitable salts, a suspended rod of copper being employed as the cathode. The sodium formed reduces the silicate to silicon, which alloys with the copper; this alloy then fuses and drops down, exposing a fresh surface of copper.

Aluminium bronze can be prepared by adding cryolite and copper oxide or chloride alternately to a bath consisting of a mixture of sodium and potassium chlorides in fusion. The anode is of carbon, and the cathode of carbon or copper.

Sodium amalgam is obtained by the electrolysis of a solution of caustic soda, the mercury which is employed as cathode being allowed to flow slowly over a series of open gutters arranged in a terrace. If acetone, for example, be added to the liquid in the cathode compartment, it is reduced by the sodium amalgam to propylic alcohol.

T. E.

Compounds of Thallium. By LOUIS M. DENNIS and MARTHA DOAN (*J. Amer. Chem. Soc.*, 1896, **18**, 970—977).—*Thallous trinitride,* TlN_3, is obtained when a concentrated solution of potassium diazoate, containing a small quantity of the free acid, is added to a solution of thallous sulphate. It crystallises in fine needles, is strongly doubly refractive, and, in an atmosphere of carbonic anhydride, melts at 334°; it is readily soluble in boiling water. When reduced in a current of dry hydrogen, it yields about 30 per cent. of its nitrogen in the form of ammonia.

Thallous thallic trinitride, TlN_3,TlN_9, is most conveniently obtained by dissolving thallic hydroxide in diazoic acid (1·6 per cent. solution), and allowing the solution to stand at 0° in an exhausted Hempel desiccator; it crystallises in yellow or brownish crystals, which are highly explosive. Hot water decomposes the compound, part of the thallium being precipitated as thallic hydroxide, whilst part remains in solution and may be precipitated as thallous iodide.

Thallous tellurate, Tl_2TeO_4, is obtained as a white, flocculent precipitate, sparingly soluble in water, on adding a solution of pure telluric acid to a solution of thallous hydroxide.

Thallous platinocyanide, $Tl_2Pt(CN)_4$ (compare Carstanjen, *J. pr. Chem.*, 1867, **102**, 144), crystallises in nearly colourless plates which are strongly doubly refractive.

J. J. S.

NOTE.—It has long ago been shown that the salt described by Carstanjen was a double carbonate and platinocyanide of thallium, and that thallous platinocyanide, when pure, is perfectly colourless. (Friswell, this Journal, 1871, 461; Friswell and Greenaway, *ibid.*, 1877, ii, 251).

Decomposition of Mercuric Sulphate by Water: Law of Thermochemical Moduli. By JOSEPH GUINCHANT (*Bull. Soc. Chim.*, 1896, [iii], 15, 1185—1191).—Varet's conclusion that mercuric sulphate dissolved in dilute sulphuric acid exists in the solution in the form of a hydrogen sulphate strictly comparable with the alkali hydrogen sulphates (Abstr., 1896, ii, 648), is not only contrary to the results of Ditte, Cameron, Le Chatelier, and other observers, but is contrary to the known chemical properties of the mercuric salts. The author points out that Favre and Silbermann's laws of thermochemical moduli are only approximate, and are not trustworthy criteria when dealing with questions of equilibrium. Moreover, Berthelot has shown that the laws only hold good in the case of strong bases, and are not applicable at all to mercuric salts. All attempts to isolate a mercuric hydrogen sulphate have failed, and the fact that, when strong sulphuric acid is added to a solution of mercuric sulphate in dilute sulphuric acid, normal mercuric sulphate is precipitated, seems to show clearly that no hydrogen sulphate exists in the solution. Varet's observation, that the heat of dissolution of the sulphate in sulphuric acid is independent of the relative proportions of acid and salt and of the concentration of the acid, is analogous to Berthelot's in the case of potassium chloride and hydrochloric acid. Further, the author's own cryoscopic observations indicate that no mercuric hydrogen sulphate is formed in the solutions. C. H. B.

Action of Fused Sodium Hydroxide under Pressure on Wrought Iron and Cast Iron. By AUGUSTE SCHEURER-KESTNER (*Bull. Soc. Chim.*, 1896, [iii], **15**, 1250—1252).—Under pressure, the action of fused sodium hydroxide on iron is distinctly greater than under ordinary conditions. Whether under atmospheric or higher pressure, the amount of corrosion increases with the temperature, and wrought iron is attacked much more readily than cast iron. These observations are of considerable practical importance now that fusions with sodium hydroxide under pressure have frequently to be carried out, and it was, in fact, a serious accident due to rapid corrosion of an iron tube that directed the author's attention to the question.

C. H. B.

Chromium Tetroxide, and Salts of Perchromic Acid. By O. FRITZ WIEDE (*Ber.*, 1897, **30**, 2178—2189).—If the blue solution obtained by extracting an aqueous solution of chromic anhydride and hydrogen peroxide with ether is cautiously treated with aqueous ammonia, the colour gradually disappears, and if the solution has been kept sufficiently cool, the under aqueous layer will have acquired a deep brown colour, and will deposit a greenish-brown precipitate on standing. This dissolves in warm 10 per cent. ammonia solution, and, on cooling, separates in the form of pale brown needles of a composition corresponding with the formula $CrO_4,3NH_3$. This compound dissolves in water, undergoing partial decomposition, explodes when heated, and evolves oxygen on treatment with strong acids. When treated with alkalis, or if the ethereal solution itself is treated with a concentrated solution of a fixed alkali instead of ammonia, chromates of the alkali metals alone are formed. Other salts of perchromic acid can be prepared by employing substituted ammonias in place of ammonia. Thus, if the ethereal solution is treated with pyridine, and the ether evaporated in a brisk current of air, blue scales are left, and if one of these be introduced into the ethereal solution after the addition of the pyridine, long, dark blue, glistening prisms gradually separate having a composition corresponding with the formula CrO_5H,C_5NH_5. They are extremely unstable, exploding violently even at the temperature of a hot summer's day; when dry, however, they can be kept in the cold for weeks, but in the presence of moisture rapidly decompose. The salt is soluble in almost all the neutral organic solvents, and is only gradually acted on by potassium permanganate in acid solution.

On adding aniline to the ethereal solution of perchromic acid, and diluting with an equal volume of light petroleum, dark red crystals, CrO_5H,NH_2Ph, separate, resembling potassium permanganate in appearance; this is even more explosive than the pyridine compound.

J. F. T.

Parastannyl Chloride. By RODOLPHE C. ENGEL (*Compt. rend.*, 1897, **125**, 464—466).—When a solution of metastannic chloride (compare Abstr., 1897, ii, 376) in dilute hydrochloric acid is heated at about 100° for some time, it rapidly acquires the property of giving a precipitate with dilute sulphuric acid which is characteristic of the β-stannic chloride of Berzelius. No compound of definite composition could be isolated from the solution, but the product approximated in composition somewhat closely to metastannic chloride.

When metastannic acid is boiled with water, it is converted into the compound $Sn_5O_{11}H_2 + 7H_2O$, and when this is dried in a vacuum it yields the hydrate $Sn_5O_{11}H_2 + 2H_2O$. Neither of these hydrates dissolves in hydrochloric acid, and therefore they differ from metastannic acid; they combine with it, however, and when the product has been dried on porcelain, it dissolves in water, and the opalescent solution gives a precipitate with sulphuric acid, but is very slowly precipitated by excess of hydrogen sulphide. The dried chloride, which has the composition $Sn_5O_9Cl_2 + 2H_2O$, is decomposed by excess of water, and the product, when dried, has the composition $Sn_5O_{11}H_2 + 2H_2O$, its potassium salt crystallises with $3H_2O$, and from it the corresponding chloride can be prepared by the action of hydrochloric acid.

The author distinguishes these compounds as parastannic compounds, and their relation to the metastannic compounds is shown in the following table.

	Dried in Air.	Dried at 100°.	Chloride.	Potassium Salt.
Metastannic ...	$Sn_5O_{11}H_2,9H_2O$	$Sn_5O_{11}H_2,4H_2O$	$Sn_5O_9Cl_2,4H_2O$	$Sn_5O_{11}K_2,4H_2O$
Parastannic ...	$Sn_5O_{11}H_2,7H_2O$	$Sn_5O_{11}H_2,2H_2O$	$Sn_5O_9Cl_2,2H_2O$	$Sn_5O_{11}K_2,3H_2O$

The contradictory statements of earlier investigators are probably attributable to the fact that they were dealing with mixtures of the different modifications of the stannic compounds.

C. H. B.

Mineralogical Chemistry.

Crystalline Form and Composition of Boulangerite. By S. A. HJALMAR SJÖGREN (*Geol. För. i Stockholm Förh.*, 1897, **19**, 153—167). —Boulangerite has long been known at Sala in Sweden, but has not previously been analysed. It occurs as acicular and capillary crystals embedded in calcite. On dissolving the calcite, striated needles are isolated which are shown to be orthorhombic and to have parameters agreeing with those of diaphorite.

	$a : b : c$
Boulangerite, $5PbS,2Sb_2S_3$..............	0·5527 : 1 : 0·7478
Diaphorite, $5(Pb,Ag_2)S,2Sb_2S_8$	0·4919 : 1 : 0·7346

The analysis by R. Mauzelius agrees with the formula $5PbS,2Sb_2S_3$, showing the mineral to be isomorphous with diaphorite.

Pb.	Ag.	Zn.	Sb.	S.	Insol. (silicate).	Total.	Sp. gr.
55·22	trace	0·06	25·54	18·91	0·23	99·96	6·185

The formula always accepted for boulangerite, namely $3PbS,Sb_2S_3$, was first given when the atomic weight of antimony was not exactly known. From a re-calculation of all the previous analyses, the iron, copper, &c. being taken as replacing lead, it is found that the majority agree with the formula $5PbS,2Sb_2S_3$, whilst none agree exactly with $3PbS,Sb_2S_3$. The first of these formulæ has previously been given by Zepharovich (1867) and Eakins (1888) for sulphantimonites of lead from Przibram and Colorado respectively. From Frenzel's analyses (1870), embrithite and plumbostibiite are made a distinct species under the name embrithite, with the formula $10PbS,3Sb_2S_3$.

L. J. S.

Vanadium in Rutile. By C. BERNHARD HASSELBERG (*Chem. News*, 1897, **76**, 102—104, 112—113; from *Astrophysical Journ.*, 1897, **5**, 194; **6**, 22—26, and *Bihang Svenska. vetensk. Akad. Handl.*, **22**, (1), No. 7).—For the purpose of mapping the lines in the arc-spectrum of titanium, rutile was the material at first employed, since this mineral is usually considered to contain, as a rule, only iron in addition to titanic acid. The lines of vanadium and chromium were, however, prominent in the spectra of several rutiles from various localities. Nordenskiöld has recently confirmed the presence of vanadium in Norwegian rutile by ordinary chemical analysis.

WILLIAM B. GILES (*Chem. News*, 1897, **76**, 137) points out that Sainte-Claire Deville was the first to detect vanadium in rutile (*Compt. rend.*, 1859, **49**, 210; *Ann. Chim. Phys.*, 1861, **61**, 309; *Chem. News*, 1861, 2).

L. J. S.

Artificial Production of Laurionite and of Isomorphous Compounds. By AUGUST B. DE SCHULTEN (*Bull. Soc. fran. Min.*, 1897, **20**, 186—191).—Laurionite, an orthorhombic oxychloride of lead, $PbCl{\cdot}OH$, found in the old lead slags of Laurion, Greece, may be prepared artificially as follows. To a boiling solution of 1000 grams of neutral lead acetate in 2·5 litres of water is added a hot solution of 50 grams of sodium chloride in 250 c.c. of water; the mixture is quickly filtered, and the filtrate heated on the water bath for 12 to 16 hours, when a deposit of well crystallised laurionite is formed. The crystals are slowly attacked by cold, but more quickly by hot, water. When heated at 100°, they are not affected, but at a low red heat they lose water and melt. The orthorhombic crystals are colourless and transparent with an adamantine lustre, the largest being 1—2 mm. in length and 0·1 mm. in thickness. The observed angles agree closely with those of the natural crystals. Similar crystals are also deposited from a cold solution of sodium chloride and lead acetate, the latter being in excess.

	a : *b* : *c*	Sp.gr.
$PbCl{\cdot}OH$	0·7366 : 1 : 0·8237	6·241
$PbBr{\cdot}OH$	0·7310 : 1 : 0·8043	6·721
$PbI{\cdot}OH$	0·7476 : 1 : 0·8081	6·827

The corresponding bromine and iodine compounds are obtained in yellow crystals by the same methods, using sodium bromide and potassium iodide instead of sodium chloride, and in the latter case in the presence of free acetic acid. Analyses of crystals of the three compounds agree closely with the formulæ. L. J. S.

Aritificial Phosgenite and Bromophosgenite. By AUGUST B. DE SCHULTEN (*Bull. Soc. fran. Min.*, 1897, 20, 191—193.)—Friedel and Sarasin have prepared phosgenite by heating lead chloride and carbonate with water, in a sealed tube at 180°. The natural occurrence, however, suggests that the mineral has been formed at the ordinary temperature.

It may also be obtained at the ordinary temperature by passing a current of carbonic anhydride over an aqueous solution of lead chloride; the bright tetragonal crystals thus formed are about 0·16 mm. across, they have the composition $PbCO_3,PbCl_2$ and sp. gr. 6·134. Those formed on the surface of the liquid are pyramidal in habit, $x\{111\}$ predominating, whilst on those deposited at the bottom $c\{001\}$ predominates.

The corresponding bromine compound is obtained by passing carbonic anhydride over a solution of lead bromide; the colourless, transparent crystals have the same crystallographic and optical characters as the chlorocarbonate; sp. gr. 6·550. Attempts to prepare the corresponding iodine compound were not successful.

L. J. S.

Simultaneous Production of Laurionite, Phosgenite, and Cerussite. By AUGUST B. DE SCHULTEN (*Bull. Soc. fran. Min.*, 1897, 20, 194—195).—Laurionite, phosgenite, and cerussite occur in association at Laurion, Greece, having been formed by the action of sea water and air on the old lead slags. The three minerals may be artificially produced together by passing a slow current of carbonic anhydride over a solution of 20 grams of normal lead acetate and 2 grams of sodium chloride in a litre of water. Bright crystals of laurionite soon make their appearance on the sides of the flask and on the surface of the liquid; shortly afterwards crystals of phosgenite are also formed, and still later cerussite is produced, apparently at the expense of the laurionite. The small twinned crystals of cerussite show the forms $p\{111\}$ and $m\{110\}$, and are deposited on the phosgenite. Experiments made on artificial laurionite and phosgenite show that, in the presence of carbonic anhydride and water, laurionite is transformed into phosgenite, which in turn is itself transformed into cerussite. L. J. S.

Crystallised Cadmium Carbonate and Artificial Dialogite [Rhodochrosite]. By AUGUST B. DE SCHULTEN (*Bull. Soc. fran. Min.*, 1897, 20, 195—198).—Rhombohedra of cadmium carbonate have been prepared by Bourgeois (1887), but attempts to obtain it by Senarmont's method have resulted in the formation of cadmium oxychloride. The method now used consists in adding excess of ammonium carbonate to a solution of cadmium chloride, and then just enough ammonia to dissolve the precipitate of cadmium carbonate; on heating this solution on the water bath, bright crystals of the composition $CdCO_3$ are deposited as the ammonia is driven off. The transparent crystals, 0·1—0·2 mm. across, are simple rhombohedra with the angle $rr' = 74°$ about; sp. gr. 4·960.

Manganese carbonate has been obtained in the form of a crystalline powder by Senarmont, and the method described above yields it as rhombohedra, but it is liable to oxidation; another method is to boil a solution of precipitated manganese carbonate in water saturated with carbonic anhydride. The bright crystals, which have the composition $MnCO_3$, are simple rhombohedra 0·03 mm. across; $rr' = 73° 25'$; sp. gr. 3·65. On heating these crystals of cadmium carbonate and manganese carbonate, they are converted into black oxide without change of external form. L. J. S.

Ferric Sulphate in Mine Waters, and its Action on Metals. By L. J. W. JONES (*Proc. Colorado Sci. Soc.*, 1897 [read June 5], 9 pp.).—Water from the Stanley mine, at Idaho Springs, Colorado, contains in parts per thousand.

SiO_2.	NaCl.	Na_2SO_4.	K_2SO_4.	$Al_2(SO_4)_3$.	$ZnSO_4$.
0·0438000	0·0134500	0·3117200	0·1554800	0·0197870	0·1224400

$MnSO_4$.	$MgSO_4$.	$CaSO_4$.	$Fe_2(SO_4)_3$.	$FeSO_4$	$CuSO_4$.	Total.
0·4271400	0·4674600	0·6362900	0·6033600	0·0093370	0·1918010	3·0020650

The water deposits a muddy brown sediment, which is shown by the following analysis, made on material dried at 100°, to be a hydrated basic ferric sulphate.

Fe_2O_3.	Al_2O_3.	SiO_2.	SO_3.	H_2O.	Total.
53·57	2·87	10·85	11·46	21·14	99·89.

The water has a strongly acid reaction, but contains no free acid; it very quickly corrodes the pumping apparatus, especially iron and copper, but bronze more slowly. Experiments showed that several metals are acted on by ferric sulphate solution. L. J. S.

Pyrophyllite from Colombia. By AUGUSTIN A. DAMOUR (*Bull. Soc. fran. Min.*, 1897, **20**, 183—185).—The emeralds of Muso, near Bogota, occur in a crystalline limestone, accompanied by a black, carbonaceous shale, and in association with parisite, pyrites, anthracite, and pyrophyllite. The anthracite has sp. gr. 1·64. The pyrophyllite occurs in greenish-white, flattened nodules with a fibrous structure. Analysis agrees approximately with the usual formula $Al_2O_3,4SiO_2,H_2O$.

SiO_2.	Al_2O_3.	Fe_2O_3.	CaO, MgO.	H_2O and volatile matter.	Total.
63·56	29·16	1·68	traces	6·36	100·76

L. J. S.

Stolzite and Raspite from Broken Hill. By CARL HLAWATSCH (*Ann. k.k. naturh. Hofmuseums Wien*, 1897, **12**, 33—41; and *Zeits. Kryst. Min.*, 1897, **29**, 130—139).—Transparent, light yellow, red, and brownish crystals of stolzite occur on galena, limonite, and psilomelane at Broken Hill, New South Wales. Five types of tabular and pyramidal crystals are described, and several new forms noted;

$a:c=1:1\cdot5606$; the tetragonal crystals show the usual parallel hemihedrism, and are not hemimorphic; they are uniaxial and negative; for sodium light $\omega=2\cdot2685$, $\epsilon=2\cdot182$. Analysis by F. P. Treadwell gave I.

	WO_3.	PbO.	MnO.	MgO.	Fe_2O_3+MnO.	Total.
I.	51·34	47·44	0·78	trace	—	99·56
II.	49·06	48·32	—	—	1·43	98·81

The new mineral raspite is found on some of the stolzite specimens as brownish or yellow monosymmetric crystals with a strong adamantine lustre. They are flattened parallel to $a(100)$, and elongated in the direction of the axis of symmetry; $a:b:c=1\cdot3493:1:1\cdot1112$; $\beta=72°\ 19'$. There is a perfect cleavage parallel to $a(100)$, and the crystals are always twinned on this plane. The plane of the optic axes is $b(010)$; the index of refraction is very high, being about 2·6. Hardness, $2\frac{1}{2}$—3. Analysis II, by Treadwell, gives the formula $PbWO_4$, showing the mineral to be dimorphous with stolzite; it may possibly be isomorphous with wolframite. L. J. S.

The Oscuro Mountain Meteorite. By RICHARD C. HILLS (*Proc. Colorado Sci. Soc.*, 1897 [read April 3], 4 pp.).—Three masses of this iron were found in December, 1895, close together on the Oscuro Mountains, Socorro Co., New Mexico, weighing respectively 1467, 1226, and 676 grams. There is no sign of weathering. Etching develops distinct Widmanstätten figures. Graphite and schreibersite are present, but no troilite was observed. Analysis gave

Fe.	Ni.	Co.	P.	C.	Total.
90·79	7·66	0·57	0·27	0·07	99·36

Other irons recently described from South Central New Mexico are the El Capitan (Abstr., 1896, ii, 193), and the Sacramento Mountains (Abstr., 1897, ii, 218). L. J. S.

Composition of the Louisville Mineral Water. By EDGAR H. S. BAILEY (*Kansas Univ. Quart.*, 1897, 6, A, 117—119).—Water issuing from limestone at Louisville, Pottawatomie Co., Kansas, has a temperature of 56° F.; at first it is quite clear, but soon becomes yellow and turbid. It has an astringent taste. Analysis gave, in 100,000 parts,

Fe_2O_3.	CaO.	MgO.	Na_2O.	K_2O.	SO_3.	Cl.	SiO_2 and insol.	CO_2.
2·84	38·17	9·32	8·05	0·52	12·89	3·85	4·64	99·90

Also traces of nitric acid and organic matter. Several waters of Kansas have more magnesium than this, but as they also contain much sodium chloride, they are not palatable. The Saline river contains more mineral matter in solution than the water of this spring.

L. J. S.

Physiological Chemistry.

Absorption of Oxygen by the Lungs. By JOHN S. HALDANE and J. LORRAIN SMITH (*J. Physiol.*, 1897, **22**, 231—258).—The absorption of oxygen in the lungs cannot be explained by diffusion alone, as the normal oxygen tension in the blood is higher than in the alveolar air, and in some animals higher than in the atmosphere. Fall of body temperature caused a marked fall in this tension. Increase of oxygen in the alveolar air causes an almost proportional increase in the oxygen tension of the arterial blood. Diminution of the oxygen tension in the alveolar air causes a fall in that of the blood; but want of oxygen, whether produced by carbonic oxide poisoning, by diminution of atmospheric pressure, or of percentage of oxygen in the air, causes a marked increase in the *relative* excess of arterial over alveolar oxygen tension. Hence want of oxygen acts as a stimulus to absorption of oxygen. The symptoms caused by diminution of the oxygen tension of the air breathed are due to fall in the oxygen tension reached by the blood in the lungs, and not to diminution in the quantity of oxygen carried by the blood from the lungs. W. D. H.

Metabolism during Inanition. By DAIBER (*Chem. Centr.*, 1896, ii, 1039, from *Schweiz. Woch. Pharm.*, **34**, 395—399).—Observations made on Succi during a 20 days' fast showed that the body weight sank about 490 grams daily, the excretion of chlorides in the urine fell to 1 or 1·5 per cent. of the normal; chlorides were not found in the urine on the twentieth day. At the beginning of the fast, urobilin was abundant, indicating decomposition of the red blood corpuscles. The metabolism of proteid as indicated by the discharge of urea was very regular. W. D. H.

Influence of the Thyroid Gland on Metabolism. By BERNHARD SCHÖNDORFF (*Pflüger's Archiv.*, 1897, **67**, 395—442).—By feeding dogs on thyroid, they are reduced in weight; this is due to loss of fat, and the amount of oxygen used is increased. When the body fat has sunk to a certain point, the proteid of the body is attacked. When the animal resumes normal diet, metabolism falls, fat and proteid are put on, and the body weight rises; renewed administration of thyroid is then followed by no increase in the excretion of nitrogen.

During menstruation in women, and the corresponding period in dogs, the proteid metabolism sinks. During hunger, the rise of nitrogenous excretion which occurs late in the process is not always coincident with the greatest deficit in fat; the organs become richer in water. W. D. H.

The Assimilation of Iron. By EMIL HÄUSERMANN (*Zeit. physiol. Chem.*, 1897, **23**, 555—592).—Analyses of various foods are given, from which it appears that the seeds of cereals are even poorer in iron than milk. Rats, rabbits, and dogs were fed on food poor in iron, and others on the same, *plus* inorganic compounds of iron, and in one series (on rats) hæmoglobin was added instead; in the last, the hæmoglobin of the blood rose considerably, although not so high as when a normal mixed diet was given. There was an increase of iron in the body, but no important increase in hæmoglobin in rats and rabbits after the administration of inorganic salts of iron; in dogs, as also in man, the hæmoglobin increases. This, however, as the author admits, hardly settles the question whether the hæmoglobin formed comes from the iron given. W. D. H.

Analyses of Blood. By EMIL ABDERHALDEN (*Zeit. physiol. Chem.*, 1897, 23, 521—531).—Two very complete analyses of the blood, one of the ox, the other of the horse, are given. W. D. H.

Coagulating Action of Gelatin on the Blood. By A. DASTRE and N. FLORESCO (*Compt. rend. Soc. Biol.*, 1896, [x], 3, 243—245).—If gelatin dissolved in solution of sodium chloride is injected into a vein of a dog, the gelatin is excreted in the urine, and the urine gelatinises on cooling. The blood, when withdrawn, coagulates with great rapidity. If, however, the blood is mixed with decalcifying agents such as potassium oxalate, it does not clot; but gelatin annuls the anti-coagulating power of proteoses (pro-peptone). W. D. H.

Glucose in the Blood and Muscle after Intra-venous Injection of that Substance. By L. BUTTE (*Compt. rend. Soc. Biol.*, 1896, [x], 3, 274—277).—After the intra-venous injection of large doses of glucose, it is excreted by the urine for about 36 hours; it is, however, not found for long in the blood, disappearing from it in about 50 minutes to 2 hours. In the muscles, also, it disappears as rapidly. It appears that of the sugar injected some is excreted, some is used immediately for purposes of combustion, and a third part probably undergoes "transformation" in certains organs.
W. D. H.

Origin of Fat in Animals. By MAURICE KAUFMANN (*Compt. rend. Soc. Biol.*, 1896, [x], 3, 414—417).—All the proximate principles of food may serve for the formation of fat. In carnivora, it originates from the proteid and fat of the food; the fat, however, is principally indirectly concerned in fat-production by preserving from oxidation the fat already stored from proteid. W. D. H.

Transformation of Fat into Glycogen. By SABRAZÈS (*Compt. rend. Soc. Biol.*, 1896, [x], 3, 239—243).—A case of fibro-lipoma growing from the mucous membrane of the mouth is described; this showed the presence of glycogen in the ulcerated portions. The glycogen was especially abundant in the leucocytes; this is believed to be due to the intracellular digestion of the fat of the tumour. W. D. H.

Breaking up of Fat in the Alimentary Canal. By VAUGHAN HARLEY (*Proc. Roy. Soc.*, 1897, 61, 249—265).—The absorption of milk-fat in normal dogs is compared with that in those from which the pancreas had been removed; the difference in the amount of fat left in different portions of the alimentary canal is not so great as would have been anticipated. Hydrolysis of fats into fatty acids and glycerol occurs in the stomach, as also does saponification; this is greater in dogs without a pancreas, and is probably explained by the fact that, in these animals, the expulsion of fat into the intestine is delayed. W. D. H.

Cholesterol in the Bile. By DOYON and E. DUFOURT (*Compt. rend. Soc. Biol.*, 1896, [x], 3, 487—489).—Doubt exists as to whether cholesterol is formed by the liver cells or by the biliary passages. It has a double origin; fistula bile contains cholesterol, but in less quantity than bladder bile. W. D. H.

Mechanism of Organic Oxidation. By J. E. ABELOUS and G. BIARNÈS (*Compt. rend. Soc. Biol.*, 1896, [x], 3, 94—96).—Two experiments are described which show that at the same time that salicylaldehyde is oxidised into salicylic acid as the result of digestion with aqueous extracts of liver, oxygen is consumed and carbonic anhydride disengaged; the extract was rendered antiseptic by chloroform. The same result follows if a solution of the precipitate produced by the addition of alcohol to the liver-extract is used instead. The "oxidising" ferment thus adheres closely to the protoplasm of the liver cells. W. D. H.

The Importance of Nucleo-proteids in the Oxidative Processes of Cells. By WILHELM SPITZER (*Pfluger's Archiv.*, 1897, **67**, 615—656).—The various tissues and organs of the body have an oxidising energy which was principally investigated in the present research by the amount of oxygen formed from hydrogen peroxide. In some cases, other tests, such as the conversion of salicylaldehyde into salicylic acid, were used as well. In their order of activity, the tissues are thus arranged, blood, spleen, liver, pancreas, thymus, brain, muscle, ovary, oviduct, the most active being placed first; this list nearly coincides with those given by Abelous and Biarnès, and by Salkowski.

The action is destroyed by protoplasmic poisons, like potassium cyanide and hydroxylamine. It is not influenced by cold to any noteworthy extent, its optimum is at 30—50°, and it is completely destroyed by heating to 70°.

The substance on which this property depends is only partially extracted by water; to say that it is an enzyme is no explanation. A definite search was made as to whether or not it depends on nucleoproteid, and the answer was in the affirmative. Nucleo-proteids were prepared from various organs and tissues by the methods given by different authors, and all were found to have the oxidising energy of the original tissue or organ; these compounds are affected by poisons and temperature like the original organs. Numerous analyses of various nucleo-proteids are given, and considerable importance in this connection is given to the constant presence of iron in them. The glycolytic power of the blood is attributed to the same substances. W. D. H.

Cerebro-spinal Fluid. By E. NAWRATZKI (*Zeit. physiol. Chem.*, 1897, **23**, 532—554).—Previous workers on cerebro-spinal fluid have all but unanimously stated that the reducing substance contained in it is not sugar. In the present case, large quantities of the fluid were obtained from calves and horses, and also from men; the author thus regards his work as being more trustworthy than that of others, who mostly worked with small quantities. Although he was not successful in separating the sugar in the crystalline form, he states that otherwise the reducing substance gives all the reactions characteristic of dextrose. He did not find catechol, as Halliburton did. In the fluids he examined, globulin was the only proteid present, proteoses and peptones being absent. The sugar in cerebro-spinal fluid disappears soon after death (glycolytic action). W. D. H.

Behaviour of Compounds of Salicylic Acid in the Organism. By STANISLAS BONDZŃYSKI (*Chem. Centr.*, 1896, ii, 1039—1040; from *Arch. exp. Path. Pharm.*, 38, 88—98).—After the use of sodium salicylate, 97·5 per cent. of it was found in the urine as salicyluric acid; after the use of ethylic salicylate, 91·3 per cent. was found in the urine. After ethylenic salicylate, 47·6 per cent. was found in the urine as salicyluric acid, and 19·5 per cent. in the fæces as salicylic acid. Of salicylglyceride, 86·7 per cent. passes unchanged through the alimentary canal, and 8·7 per cent. is excreted in the urine as salicyluric acid. Dichlorhydrin-salicylate appears chiefly in the urine (92·7 per cent.). After the use of salicyl compounds soluble in water, such as salicylamide, there was complete absorption, none being found in the fæces. W. D. H.

Physiological Action of Nicouline. By ED. BOINET (*Compt. rend. Soc. Biol.*, 1896, [x], 3, 403—406).—*Nicouline*, C_3H_4O, a colourless, inodorous substance crystallising in rhomboidal tablets, was extracted by Geoffroy from *Robinia Nicou Aublet*, a leguminous plant used by the natives of Guiana to stupefy and capture fish.

The action of nicouline is on the central nervous system, especially on the bulb; after a phase of excitation, stupor sets in, the muscles are relaxed, sensation is in abeyance, and the temperature falls. It is rapidly eliminated. The fatal dose for mammals is 1 milligram per 10 grams of the body weight. W. D. H.

Action of Scopoline and Scopoleines. By ARNOLD SCHILLER (*Chem. Centr.*, 1896, ii, 1039; from *Arch. exp. Path. Pharm.*, 38, 71—87).—Scopoline, on account of its insolubility, does not act on frogs, but the scopoleines (cinnamylscopoline, benzoylscopoline, acetylscopoline) produce narcosis, with a rise of reflex irritability. The cinnamyl compound is the most active, 0·01—0·02 gram producing a marked effect; in rabbits and cats, however, 0·12 gram produces no corresponding results. In contradistinction to scopolamine, scopoline and the scopoleines produce no effect on the pupil, secretion of saliva, or vagus endings in the heart. W. D. H.

Physiological Action of Copper. By ARNOLD KOLDEWEY (*Chem. Centr.*, 1896, ii, 1041; from *Dissert. Berlin*).—Although it is advisable to obviate admixture of copper with the food, no noteworthily evil results follow small doses of copper, or even large doses in people in good health, or in animals that vomit readily; long continuance in the use of copper, however, produces slight degenerative changes in the liver and kidney, which can only be detected on microscopic examination. The existence of chronic copper poisoning among workers in that metal is doubted, and illness, if it occurs, is probably to be attributed to arsenic, zinc, or lead mixed with the copper. W. D. H.

Composition of Normal Urine. By Charles Platt (*J. Amer. Chem. Soc.*, 1897, **19**, 382—384).—The amounts of the various constituents of the urine of men and women are arranged in a lengthy table. The numbers given are averages compiled from the observations of the author (number not stated) and those of forty-eight other investigators; they do not differ in any essential particular from those found in the text-books. W. D. H.

Excretion of Phosphorus during Feeding with Casein. By Gotthelf Marcuse (*Pflüger's Archiv.*, 1897, **67**, 373—394).—The experiments were carried out in the usual manner of metabolism experiments; a dog was used, and the phosphorus in its food (casein and meat extract), and in its excrements, was estimated. In four experiments, the average of phosphorus absorbed from the food was 90 per cent. of that given; this is even better than when meat is given. The phosphorus thus follows the same course as was previously shown in the case of the nitrogen of casein, thus confirming the view, previously found expressed, of the high nutritive value of casein. W. D. H.

Nitrogenous Excretion in Phloridzin-diabetes. By Ch. Contejean (*Compt. rend. Soc. Biol.*, 1896, [x], **3**, 344—347).—In phloridzin-diabetes in animals, the excretion of nitrogen is not increased, as von Mering states, and proteid cannot therefore be regarded as the precursor of sugar. The opinion expressed is that the sugar is formed, partly, if not exclusively, from the fat of the organism.
W. D. H.

Uric Acid in the Saliva in the Uric Acid Diathesis. By Boucheron (*Compt. rend. Soc. Biol.*, 1896, [x], **3**, 454—456).—By the murexide test, uric acid can be detected in the saliva in patients suffering from the uric acid diathesis, particularly in the intervals between meals. An analogy is drawn between this and the occurrence of sugar in the urine in diabetes. W. D. H.

Toxicity of Aqueous Solutions of Phosphorus. By Thomas Bokorny (*Chem. Zeit.*, 1896, **20**, 1022).—Phosphorus is a poison to low organisms, but not a powerful one. As with nitroglycerol, there is here a difference between low animals and plants and those higher in the scale. W. D. H.

Excretion of Water and Carbonic Anhydride from Inflamed Skin. By Wakelin Barratt (*J. physiol.*, 1897, **22**, 206—214).—In dry dermatitis produced by carbolic acid, the output of water is much diminished (56 per cent.); this persists till desquamation is completed. No marked alteration is noted in the elimination of carbonic anhydride, until, when desquamation is in progress, the horny epithelium becomes thinner; there is then a tendency to increased output. W. D. H.

Glycosuria after Carbonic Oxide Poisoning. By Walther Straub (*Chem. Centr.*, 1896, ii, 1040; from *Arch. exp. Path. Pharm.*, 38, 139—157).—After poisoning dogs by carbonic oxide, sugar appears in the urine if proteid decomposition occurs; but in proteid hunger, or with excess of carbohydrate food, it is absent. Administration of gelatin will take the place of proteid in this connection.

W. D. H.

Nitroglycerol as a Poison. By Thomas Bokorny (*Chem. Zeit.*, 1896, **20**, 1021—1022).—Nitroglycerol is a very feeble poison to low organisms, whilst nitroethane is not only non-poisonous to these, but appears to increase their nutrition. W. D. H.

Chemistry of Vegetable Physiology and Agriculture.

Nitrated Carbohydrates as Food Material for Moulds. By Thomas Bokorny (*Chem. Zeit.*, 1896, **20**, 985—986).—Cellulose trinitrate (nitrocellulose) will serve as a food supply for moulds when suspended in distilled water containing the requisite mineral matter and placed in the dark. The growth is rapid, and a considerable quantity of the vegetable growth accumulates round the masses of cellulose nitrate, but no growth is observed if mineral matter is absent. Cellulose itself cannot act as a food supply, and it seems probable that if glycerol is present cellulose nitrate is no longer made use of.

J. J. S.

Fixation of Atmospheric Nitrogen by the Association of Algæ and Bacteria. By Raoul Bouilhac (*Compt. rend.*, 1896, **123**, 828—830).—*Nostoc punctiforme* was cultivated in flasks containing (Nos. 1—6) nutritive solutions free from nitrogen, with and without soil bacteria. A second series of experiments was made (Nos. 7—18) in which potassium arsenate (As = 0·01 per cent.) was added to the nutritive solution. It had been previously shown that certain algæ are able to live in presence of arsenic. The following results were obtained.

No.		Dry produce (grams).	Nitrogen.	
			Total (grams).	Per cent. in dry subst.
1—3	without bacteria	—	—	—
4	with bacteria	0·705	0·0234	3·3
5	,, ,,	0·564	0·020	3·5
6	,, ,, and *Hypheothrix*	0·353	0·0111	3·1
7—10	without ,,	—	—	—
11	with ,,	0·322	0·0105	3·2
12	,, ,,	0·295	0·0118	4·0
13	,, ,,	0·183	0·0065	3·5
14	,, ,,	?	?	?
15	,, ,,	0·154	0·0058	3·7
16	,, ,, *Hypheothrix* and *Pleurococcus*	0·322	0·0107	3·3
17	,, ,, ,, ,, *Ulothrix*	0·381	0·012	3·6
18	,, ,, and ,,	0·545	0·0206	3·7

There was, therefore, fixation of nitrogen during the growth of algæ associated with bacteria, and the percentage of nitrogen in the produce is comparable with that of the *Leguminosæ*. Like *Nostoc*, the bacteria are capable of living in presence of arsenic in the quantity employed.

Schizothrix lardacea and *Ulothrix flaccida* failed to develop in absence of combined nitrogen, both with and without soil bacteria.

N. H. J. M.

Action of Formaldehyde on Germination. By Richard Windisch (*Landw. Versuchs.-Stat.*, 1897, **49**, 223—226).—Selected seeds (200 of each) of winter-wheat, rye, barley, and oats were allowed to germinate between thick Swedish filter paper, with distilled water alone, and in presence of different amounts of formaldehyde (0·02 to 0·40 per cent.). The experiments extended over 12—16 days. The weakest solution retarded, on the first day, the germination of barley, wheat, and rye, but was favourable to oats as compared with water alone. The 0·08 per cent. solution had a considerable retarding effect, especially in the case of rye and wheat, but less with barley; oats germinated normally. With 0·12 per cent. of formaldehyde, the wheat was mostly destroyed, whilst the germination of oats, although retarded, was otherwise normal. The following results show the average percentage of seeds of each kind which germinated under the influence of the solutions of different strengths. There were two experiments in each case.

Formaldehyde per cent.	0	0·02	0·04	0·08	0·12	0·20	0·40
Barley	96·5	95·5	97·5	89·0	47·0	none	none
Wheat	98·0	97·25	97·25	88·5	9·25	,,	,,
Oats	97·0	99·50	99·25	96·5	95·5	64·5	,,
Rye	96·25	93·5	91·05	65·25	20·50	1·5	,,

The results of the duplicate experiments given differed by less than 5 per cent.

N. H. J. M.

How is the High Percentage of Iron in the Ash of Trapa natans to be Explained? By George Thoms (*Landw. Versuchs.-Stat.*, 1897, **49**, 165—171).—The nuts examined were obtained from a lake near Jacobstadt in Courland, and included (1) black nuts which had been at least a year in the mud at the bottom of the lake, and (2) fresh nuts still containing the kernels. The following analytical results were obtained.

	Dry matter (grams).	Ash (grams).	Insoluble in HCl (grams).	Fe_2O_3 (grams).	In dry matter, ash per cent.	In ash, Fe_2O_3 per cent.
Kernels of 6 fresh nuts	5·2846	0·1740	0·0007	0·0023	3·29	1·32
Shells ,, ,, ,, ,,	5·9328	0·1896	0·0034	0·0025	3·20	1·34
Black nuts (2)	1·4692	0·1100	0·0082	0·0746	7·48	67·82

The comparatively small amount of iron in the fresh nuts indicate that iron has no physiological *rôle*. It is supposed that the porous tissues of the dead nuts which contain tannin, precipitate the iron present in the water which surrounds them, until the whole of the tannin is used up. This would account for the blackening of the nuts, and also accords with the results of analyses of black oak found in the river near Riga. The wood contained: water, 8·02; ash in dry substance 1·22, and Fe_2O_3 (in the ash) 50·14 per cent. (compare E. von Gorup-Besanez, *Annalen*, 118, 220—227). N. H. J. M.

Sugar and Starch in Resting Potatoes. By WILHELM BERSCH (*Chem. Centr.*, 1896, ii, 1121; from *Österr.-ung. Zeit. Zucker.-Ind. u. Landw.*, **25**, 766—793).—If potatoes are slowly frozen, or kept for a long time near their freezing point (−1°), some of the starch is changed into sugar, but if the freezing is done rapidly, no sugar can be detected; the sugar formed is chiefly dextrose, but partly cane-sugar. If they are again warmed, part of the sugar is used for respiratory purposes, and part is again transformed into starch. W. D. H.

Formation of Starch. By THOMAS BOKORNY (*Chem. Zeit.*, 1896, **20**, 1005—1006).—In absence of organic matter, carbonic anhydride, light, and potash are necessary for the production of starch, whilst in presence of sugar or glycerol, &c., light is not essential (compare E. Laurent, "*Sur la formation d'amidon dans les plantes,*" Brussels, 1888). This does not, however, hold good for all plants, as, for instance, *Spirogyra maxima,* which failed to produce starch in 48 hours in 1 per cent. sugar (cane-sugar, dextrose, and xylose). Moreover, *Spirogyra* could be freed from starch by keeping it 5—10 days in darkness; in 1 per cent. dextrose (both with 0·5 per cent. potassium nitrate and without potash); the dextrose did not even delay the disappearance of the starch. In presence of light, *Spirogyra* produced starch abundantly from cane-sugar, grape-sugar, and glycerol, &c., but not in an atmosphere of hydrogen.

Similar results were obtained with *Confervæ.* Whilst many plants, such as potatoes, convert sugar into starch in absence of light, it is still unknown whether the presence of oxygen is necessary or not.

N. H. J. M.

Formation of Non-nitrogenous Reserve Substances in Walnuts and Almonds. By LECLERC DU SABLON (*Compt. rend.*, 1896, **123**, 1084—1806).—Walnuts and almonds were examined at different periods of growth, commencing in July and June respectively, when the embryo was only slightly developed. They were dried for 3 days at 45°; glucose, saccharose, and the amyloses were determined. The following percentage results in dry matter are given, as well as the amount of water to 100 points of dry matter.

	Water.	Oil.	Glucose.	Saccharose.	Amyloses.
1. Walnuts, 6 July......	837	3	7·6	0	21·8
,, 1 Aug. ...	535	16	2·4	0·5	14·5
,, 15 Aug. ...	274	42	0	0·6	3·2
,, 1 Sept. ...	48	59	0	0·8	2·6
,, 4 Oct.......	10	62	0	1·6	2·6
2. Almonds, 9 June ...	896	2	6·0	6·7	21·6
,, 4 July......	716	10	4·2	4 9	14·1
,, 1 Aug. ...	219	37	0	2·8	6·2
,, 1 Sept. ...	117	44	0	2·6	5·4
,, 4 Oct.	12	46	0	2·5	5·3

The amount of fatty acids was much greater during the earlier stages of development than later, owing to conversion into carbohydrates; glucose is also to be considered as an intermediate product. In almonds, there was decrease in the percentage amount of saccharose, but an increase in actual amount. N. H. J. M.

Amount of Lecithin in some Seeds and Oil Cakes. By ERNST SCHULZE (*Landw. Versuchs.-Stat.*, 1897, **49**, 203—214).—The following amounts of lecithin were found in various seeds and cakes (per cent. of dry matter).

Seeds: Blue and yellow lupins (without husks), 2·20 and 1·64; vetches, 1·09; peas, 1·05; lentils, 1·03; wheat, 0·43; barley, 0·47; maize 0·25; buckwheat, 0·53; flax, 0·73; hemp, 0·85; *Pinus sylvestris*, 0·49; *Picea excelsa*, 0·27; *Abies pectinata*, 0·11 (compare Stoklasa, Abstr., 1897, ii, 116).

Cakes: Earth-nut (1), 0·20; (2) 0·37; sesame, 0·49; linseed, 0·44; cocoanut, 0·30; cotton seed, 0·49. Maxwell (Abstr., 1891, 511) found 0·94 per cent. of lecithin in cotton-seed.

The above results can only be correct on the assumption that lecithin is the only compound, soluble in alcohol and ether, which contains phosphorus; this may safely be assumed in the cases under consideration, namely, seeds and oil cakes, but perhaps not in the case of chlorophyllous objects (Stoklasa, Abstr., 1897, ii, 116).

Lecithin isolated from wheat germs had all the properties of preparations from leguminous seeds.

Before extracting with ether and alcohol, seeds must be very finely ground. Seeds which contain much fat are first coarsely ground, extracted with ether, and then ground as finely as possible. Von Bitto (Abstr., 1894, ii, 402) recommended extraction with methylic alcohol. The author found, however, that the "purest methylic alcohol," from different sources, dissolved small amounts of potassium and sodium phosphates, and determinable amounts of phosphorus from seeds from which the whole of the lecithin had previously been extracted.

N. H. J. M.

A Phosphorus Compound from Plants, which yields Inosite on Decomposition. By ERNST WINTERSTEIN (*Ber.*, 1897, **30**, 2299—2302).—The compound containing phosphorus in combination with calcium and magnesium, which was extracted from the seeds of *Sinapis nigra* by means of dilute sodium chloride solution, is now found to be most conveniently extracted by heating the dried seeds with dilute acetic acid; it is a white, earthy, amorphous mass, and after removal of the calcium by means of oxalic acid, yields a compound containing 42·24 per cent. P_2O_5 and 12·97 per cent. MgO. An attempt to obtain the free acid was unsuccessful, although on heating the magnesium salt in a closed tube with concentrated hydrochloric acid at 140° for 30 hours, inosite was formed. J. F. T.

Lactic Acid in Algerian Wines. By JOSEPH A. MULLER (*Bull. Soc. Chim.*, 1896, [iii], **15**, 1210—1213).—The author has analysed fourteen Algerian wines, the lactic and succinic acids being separately estimated by the method that he has described (this vol., ii, 57). The total solid residue at 100° varied from 20·00 to 35·00 grams per litre, the total acidity, in terms of sulphuric acid, from 5·49 to 9·82, the lactic acid from 0·52 to 4·54, and the succinic acid from 0·66 to 1·60 grams per litre, whilst the alcoholic strength varied 9·85 to 13·00 per cent. by volume. The relative proportions of lactic acid and mannitol show that the greater part of the former has not been produced by a mannitol fermentation of glucose or levulose. The wines contain the vibrios found by Pasteur in "turned" wines, but differ from the latter in containing normal proportions of tartrates and of glycerol. All the wines, however, contain a notable proportion of glucose, and it seems most probable that the vibrios, before attacking the glycerol and the tartrates, convert a larger or smaller proportion of the glucose into lactic acid. The "turning" ferment is widely diffused, and the high temperatures that prevail in Algeria often prevent the completion of the alcoholic fermentation whilst favouring the development of the vibrios.

C. H. B.

Composition of Potatoes. By Balland (*Compt. rend.*, 1897, **125**, 429—431).—Analyses of a large number of varieties of potatoes, grown in France, gave the following results.

		Water.	Nitrogen compounds.	Fats.	Sugars and starch.	Cellulose.	Ash.	Weight of tubers.
Ordinary condition	Minimum	66·10	1·43	0·04	15·58	0·37	0·44	23·0 grams.
	Maximum	80·60	2·81	0·14	29·85	0·68	1·18	420·0 ,,
Dry	Minimum	0·0	5·98	0·18	80·28	1·40	1·66	
	Maximum	0·0	13·24	0·56	89·78	3·06	4·38	

The proportion of water is independent of the size of the tubers and of the variety of potato, but seems to be closely connected with the character of the soil; moreover, the proportion of nitrogen compounds varies considerably in different varieties. The ash generally contains traces of manganese. The acidity varies from 0·072 to 0·250 per cent. Young tubers do not differ from mature tubers in composition except that the envelope amounts to only about 3 per cent. and the proportion of cellulose is about seven times as great in the young as in the mature tubers. When cooked in water, potatoes alter very little in weight. Three kilograms of boiled, or about 1200 grams of fried potatoes contains almost exactly the same quantity of nitrogen compounds and starches as 1 kilogram of ordinary white bread.

C. H. B.

Banana Flour. By John B. Coppock (*Chem. News*, 1897, **75**, 265—266).—In some parts of Cuba, the fruit of *Musa paradisiaca*, a variety of banana, is the chief food of the natives; a sample of the flour had the following percentage composition: water, 10·62; proteids, 3·55; fat, 1·15; carbohydrates, 81·67; fibre, 1·15; phosphoric acid, 0·26; salts other than phosphates, 1·60. The flour has the appearance of finely-ground oatmeal, has an agreeable odour, and quickly forms a thin, readily digestible mucilage with warm water. The starch granules are elongated and elliptical, and consist of concentric layers.

D. A. L.

Composition of the Seeds of Mangel Wurzel. By ARTHUR DEVARDA (*Landw. Versuchs.-Stat.*, 1897, **49**, 239—240).—The entire seeds (shell and kernel) of seven (mostly Austrian) varieties of mangel wurzel were analysed. The average percentage composition of the dry matter (88·45 per cent. in the fresh substance) was as follows:

N × 6·25.	Crude fat.	N-free extract.	Crude fibre.	Ash.
12·84	6·08	38·41	34·01	8·38

The pure ash contained (per cent.)

K_2O.	Na_2O.	CaO.	MgO.	Fe_2O_3.	P_2O_5.	SO_3.	SiO_2.	Cl.
22·01	8·01	16·14	11·07	1·03	10·00	5·01	24·61	2·32

N. H. J. M.

Analytical Chemistry.

Sensitive Litmus Paper. By RONDE (*Chem. Centr.*, 1896. ii, 1130; from *Pharm. Zeit.*, 41, 736).—Coarsely powdered litmus is digested during one day with 12—15 parts of water, and the dark-blue mixture after being treated with concentrated sulphuric acid until the colour turns to bright red, is heated on a water bath to expel carbonic anhydride; dilute sulphuric acid is then added until filter paper dipped in the liquid just appears violet-red. When cold, the liquid is filtered, and by addition of more dilute sulphuric acid, or of powdered litmus, it is adjusted so as to give either a blue or a red stain to filter paper. M. J. S.

Application of Iodic Acid to the Analysis of Iodides. By FRANK A. GOOCH and C. F. WALKER (*Amer. J. Sci.*, 1897, [iv], **3**, 293—300, and *Zeit. anorg. Chem.*, **14**, 423—431).—The authors have worked out a new process for the estimation of iodides. An excess of solution of potassium iodate is first added, and then dilute sulphuric acid, which causes iodine to be set free; solution of potassium hydrogen carbonate is then added in slight excess, followed by a very slight excess of standard arsenious acid; finally, the undecomposed arsenious acid is titrated with standard iodine, using starch solution as indicator. The amount of iodine to be estimated is five-sixths of the iodine thus found.

To ensure success, the amount of iodide should be something like 0·08 gram dissolved in 150 c.c. of liquid. Small quantities of bromides or chlorides do not interfere with the process. L. DE K.

Detection of Fluorine in Silicates and Borates. By JULIUS A. REICH (*Chem. Zeit.*, 1896, **20**, 985).—The substance is gently heated with a little strong sulphuric acid in a platinum crucible covered with a watch glass, which is placed with its convex side downwards, and is moistened with a drop of water. If fluorine is present, a coating of silicic or boric acid will soon be visible; the latter readily dissolves in a drop or two of water. L. DE K.

Estimation of Sulphur in Iron. By Wilhelm Schulte (*Chem. Centr.*, 1896, ii, 1132; from *Stahl und Eisen*, **16**, 865).—The iron (10 grams) is dissolved in 200 c.c. of hydrochloric acid (1 vol. of sp. gr. 1·19 diluted with 2 vols. of water), and the gases passed through 45—50 c.c. of a solution containing 5 grams of cadmium acetate, 20 grams of zinc acetate, and 200 c.c. of glacial acetic acid per litre; when the reaction is complete, and the absorbent solution is warmed to 30—40° by the escaping steam, 5—7 c.c. of copper sulphate solution (80 grams of crystallised copper sulphate and 320 grams of concentrated sulphuric acid per litre) is added, whereby the precipitated sulphides are immediately converted into copper sulphide. This is collected, washed with hot water, roasted, and then strongly ignited until converted into cupric oxide, from the weight of which the sulphur is calculated. Cupric acetate cannot be used for the original absorption, in consequence of the presence of hydrogen phosphide, by which some copper would be precipitated. M. J. S.

Estimation of Total Ammonia in Gas-liquors. By Eduard Donath and K. Pollak (*Zeit. angw. Chem.*, 1897, 555—557).—The authors have proved that the only trustworthy process for estimating ammonia in gas-liquors is the distillation method. The gas-volumetric process, consisting in liberating the nitrogen by means of bromine dissolved in aqueous soda, gives results which are decidedly too high. This is caused by a partial decomposition of the thiocyanates always present in the samples. L. de K.

Estimation of Nitric Acid by Electrolysis. By Karl Ulsch (*Zeit. Elektrochem.*, 1897, **3**, 546—547).—The nitric acid is electrolytically reduced to ammonia, employing as the cathode a spiral of about forty turns of soft copper wire, about 1·4 mm. thick, wound on a glass tube of about 15 mm. diameter, the coil being afterwards stretched out to a length of about 70 mm.; before use, the copper spiral is heated to dull redness and quenched in water; a platinum wire, 1 mm. thick and 20 cm. long, is employed as the anode. These electrodes reach almost to the bottom of a test-tube, and are held in place by a rubber stopper, through which a glass tube passes to permit of the escape of gases; the current of 1·25 ampères (or 1·5 amp. per sq. dm.) employed is furnished by two accumulators in series. The nitrate is dissolved in semi-normal sulphuric acid. Until some 90 per cent. of the nitrate is reduced, no hydrogen is evolved, and 10 minutes after the first bubbles of hydrogen come off the reduction is completed. The results obtained with potassium nitrate are very accurate so long as at least two-fifths of the sulphuric acid originally present remains unneutralised, but unfortunately, many substances, especially chlorides, which accompany naturally occurring nitrates, are prejudicial to the accuracy of the method. T. E.

Estimation of Nitrates in Soil. By L. Kuntze (*Chem. Centr.*, 1896, ii, 1133; from *Zeit. Ver. Rubenzuck. Ind.*, 1896, 761).—An attempt to utilise the reaction with brucine and sulphuric acid as a quantitative one, by comparing the depth of colour produced by a single drop of the soil extract with that yielded by a drop of a standard nitrate solution, failed to give constant results, the depth of colour varying both with the size of the drops and with the quantity of sulphuric acid added. M. J. S.

Estimation of Nitrogen in Nitrated Guanos. By V. Schenke (*Chem. Zeit.*, 1896, **20**, 1031—1033).—The author again states that the only method which gives satisfactory results with "nitrated guanos" is the one proposed by him in 1893, which he termed the Ulsch-Kjeldahl method.

In this process, the nitric nitrogen is first reduced by means of reduced iron and dilute sulphuric acid, and the whole is then boiled with sulphuric acid and a drop of mercury until the organic matter is destroyed. The ammonia is then determined as usual (Abstr., 1894, ii, 67). L. de K.

Detection of Nitrites in Potable Water. By A. Gawalowski (*Chem. Centr.*, 1896, ii, 1009; from *Zeit. Nahrungsm. Hyg. War.*, **10**, 315).—The reaction with potassium iodide and starch is only trustworthy when the iodide is free from iodate, and has been preserved in the dry state and in the dark in bottles of yellow or blue glass; dilute hydrochloric acid should be used for acidifying, since dilute sulphuric acid is apt to be reduced by dust to sulphurous acid. It is necessary that the starch should be washed immediately before it is gelatinised, and that the starch-paste be freshly made. M. J. S.

Analysis of Phosphor-bronze, Phosphor-copper, Phosphor-tin, &c. By Max Wickhorst (*J. Amer. Chem. Soc.*, 1897, **19**, 396—398).—*Estimation of Phosphorus alone.*—One gram of the sample is heated with a mixture of 15 c.c. of nitric and 5 c.c. of hydrochloric acid. When oxidised, the acid liquid is diluted, mixed with ammonia in excess, and the whole made up to 200 c.c.; hydrogen sulphide is then passed through the solution until the copper, lead, &c., are entirely precipitated. Ammonia and magnesium mixture are added to 100 c.c. of the filtered liquid, and after a few hours the magnesium phosphate is collected, washed with dilute ammonia containing a little ammonium sulphide, and weighed, as usual, as magnesium pyrophosphate.

Complete Analysis of Phosphor-bronze.—Half a gram of borings, treated with 5 c.c. of strong nitric acid until fully oxidised, is diluted with water and the insoluble matter collected on a filter and washed with dilute nitric acid. The filter and contents are then ignited in a weighed porcelain crucible, being gradually heated to redness; the weight is that of the stannic oxide *plus* phosphoric anhydride. After being fused with 0·5 gram of dry sodium carbonate and 1 gram of sulphur, with the cover on the crucible, until the excess of sulphur is volatilised, it is allowed to cool, and the fused mass dissolved in water; excess of ammonia and 1 gram of ammonium chloride are then added, and the phosphoric acid precipitated with magnesium mixture. The precipitate should be purified by redissolving it in a little hydrochloric acid and reprecipitating with ammonia, before finally weighing as magnesium pyrophosphate. From the latter, the phosphorus can be calculated and also the corresponding amount of phosphoric anhydride; the latter deducted from the weight of the stannic precipitate gives the stannic oxide, which is then calculated to tin. As, however, a little of the phosphoric acid passes into the original nitric acid filtrate, it is advisable to make a special duplicate experiment in which the phosphoric acid in the filtrate can be estimated by the molybdic process.

To the acid filtrate, after it is neutralised with ammonia, 5 c.c. of nitric acid is added, the whole diluted to 150 c.c., introduced into a large platinum dish, and electrolysed, the lead being precipitated as dioxide on the dish and the copper on the negative electrode, which consists of a piece of platinum foil 2 inches square. The liquid contains any iron or zinc which may be present; these are precipitated as sulphides by adding ammonia and ammonium sulphide, and the precipitate, after being collected and ignited in a porcelain crucible, is weighed; the mixed iron and zinc oxides are dissolved in hydrochloric acid and the ferric oxide precipitated with ammonia, the zinc oxide being found by difference. L. DE K.

Estimation of Phosphoric Acid in Potable Waters. By CHARLES LEPIERRE (*Bull. Soc. Chim.*, 1896, [iii], 15, 1213—1217).—The estimation of phosphoric acid in potable waters by weighing the ammonium phosphomolybdate is inexact, because the solubility of the precipitate in dilute nitric acid introduces errors of the same order of magnitude as the quantities to be determined.

The author finds (1) that at equal temperatures the intensity of the yellow colour of the liquid after addition of the molybdate is directly proportional to the quantity of phosphoric acid present, at any rate up to 0·03 gram per litre, and (2) the intensity of the coloration increases with the temperature, and between 10° and 30° is directly proportional to the temperature, the increase in intensity with rise of temperature being represented by straight lines.

Solutions of potassium chromate form a convenient colour scale, but a scale can also be made by means of dilute solutions of a phosphate, 50 c.c. of which is mixed with 2 c.c. of a molybdate solution prepared by dissolving 150 grams of ammonium molybdate in 1000 c.c. of water, and pouring this solution into 1000 c.c. of nitric acid of sp. gr. 1·2. The tubes are well corked, and the corks covered with paraffin; the solutions remain unaltered for two or three months, but those containing more than 0·010 gram of phosphoric acid per litre gradually deposit a precipitate after that time. When kept at 40° for several days, no precipitate forms even in the solutions that contain 0·025 gram of phosphoric acid per litre.

A litre of the water is evaporated after addition of nitric acid, and the residue is repeatedly evaporated with nitric acid to separate all the silica; it is then dissolved in 50 c.c. of nitric acid, mixed with 2 c.c. of the molybdate solution, and the intensity of the yellow coloration compared with the scale of units.

The presence of silica introduces an error, but the coloration due to phosphoric acid reaches its maximum intensity almost instantaneously, whereas with silica the intensity increases slowly. Observations made after sufficient intervals of time will show whether the intensity is increasing or is constant. C. H. B.

Solubility of Phosphates in Citric Acid and Ammonium Citrate. By Otto Foerster (*Chem. Zeit.*, 1897, 20, 1020—1021).—The author's experiments prove that there is yet a good deal to be investigated before the citrate-solubility controversy is finally settled.

It appears that this solubility is greatly influenced by the amount of soluble silica. Another strange thing is that some phosphates were found to be more soluble in Wagner's ammonium citrate solution than in a 1·4 per cent. solution of citric acid, whilst the majority of phosphates are more readily soluble in the latter. L. de K.

Arsenical Sulphuric Acid, a Source of Error in Naumann's Process for Estimating Phosphoric Acid. By Gustav Loges and Karl Mühle (*Chem. Zeit.*, 1896, 20, 984).—In Naumann's process for estimating phosphates soluble in citric solution, the citric acid solution of the basic slags is boiled with sulphuric and nitric acids until the organic matter is destroyed. The phosphoric acid is then estimated by the magnesia or molybdate method.

If there is any arsenic present in the sulphuric acid employed, this will be oxidised to arsenic acid, and will then be precipitated along with the phosphoric acid. The use of a pure acid is therefore indispensable. L. de K.

Estimation of Boric Acid in Foods. By Leonard de Koningh (*J. Amer. Chem. Soc.*, 1897, 19, 385—388).—When using Thomson's process for estimating boric acid, it is necessary to completely expel by boiling any carbonic anhydride that may be present; the author states that there is no fear of loss of boric acid, even if the boiling is continued for 15 minutes, which is far longer than is necessary.

When dealing with articles of food, the presence of phosphoric acid has to be taken into account; a process of separating it by means of calcium chloride is given, differing greatly in detail from that previously published by Thomson. A new process is also described by which the boric acid can be estimated after removal of the phosphoric acid by means of magnesium mixture; the filtrate is mixed with excess of sodium carbonate and heated, the precipitate of magnesia is removed by filtration, the filtrate evaporated to dryness to render the rest of the magnesia insoluble, and the residue is then treated with a little water and filtered. The boric acid can be titrated according to Thomson's directions. As a test experiment, 0·1 gram of boric acid was dissolved in aqueous soda, and mixed with 100 grams of oatmeal and incinerated; from the ash, 0·095 gram of boric acid was recovered.
L. de K.

Estimation of Silica in Blast-furnace Slag. By G. H. Meeker (*J. Amer. Chem. Soc.*, 1897, 19, 370—374).—The author recommends the following process, which is particularly suitable if the sample contains an admixture of spinel. 0·5 gram of the finely ground slag is placed in a small dish, moistened with 3 c.c. of water, 10 c.c. of hydrochloric acid added, and the whole well stirred. When the slag has nearly all dissolved, 40 c.c. of dilute sulphuric acid (1 : 1) is added, and the mixture boiled until fumes of sulphuric acid are given off. When cold, a little water and 10 c.c. of hydrochloric acid are added, and the whole is boiled for a minute. The insoluble matter, consisting of nearly chemically pure silica, is collected on a filter, and after being washed with hot dilute hydrochloric acid and then with water, is ignited and weighed. L. DE K.

Separation of Silicic and Tungstic Acids. By JAMES S. DE BENNEVILLE (*J. Amer. Chem. Soc.*, 1897, 19, 377—379).—The author confirms the statement that tungstic acid cannot be accurately separated from silica by means of ammonia, as the latter is also sensibly soluble in that liquid; the solubility is certainly diminished if it has been strongly ignited, but in that case the tungstic acid also becomes less readily soluble.

The best plan is to first weigh the mixed oxides, then to remove the silica by evaporating with hydrofluoric and sulphuric acids, and weigh the residue of tungstic acid. L. DE K.

Estimation of Potash and Phosphoric Acid in Fodders. By HARVEY W. WILEY (*J. Amer. Chem. Soc.*, 1897, 19, 320—322).—This is a slight modification of the Lindo-Gladding process for estimating potash, and admits of the determination of the phosphoric acid in the same portion of the sample.

Eight grams of the substance is burnt as completely as possible over a small flame, the ash is dissolved in 50 c.c. of water mixed with 5 c.c. of hydrochloric acid, and transferred to a 200 c.c. measuring flask. Some ferric chloride is added to precipitate the phosphoric acid, and then 10 c.c. of strong ammonia and 10 c.c. of a 20 per cent. solution of ammonium carbonate. After heating on the water bath for an hour, the liquid is left over-night, made up to the mark, thoroughly shaken, and poured on to a large filter; when this is drained and has become somewhat dried, it is put back into the flask. Dilute nitric acid is added to dissolve the ferric phosphate, the solution is made up to a definite bulk, and an aliquot part is used for the estimation of the phosphoric acid.

Fifty c.c. of the filtrate containing the potassium is then evaporated to dryness in a platinum dish, the bulk of the ammonium chloride expelled by heating, and the residue, after being moistened with 1 c.c. of dilute sulphuric acid (1 : 1), is again gradually heated to redness. The potassium is then estimated by means of platinic chloride by the Lindo-Gladding method. The washing with alcohol, solution of ammonium chloride, and the final washing with alcohol are best done in a Gooch crucible. After weighing the double chloride, the contents of the crucible are dissolved in boiling water, and the crucible is dried and re-weighed. L. DE K.

Electrolytic Estimation of Cadmium. By S. AVERY and BENTON DALES (*J. Amer. Chem. Soc.*, 1897, 19, 379—382).—The authors, having in view the excellent results obtained when electrolysing zinc from a formate solution, have applied the same process to cadmium with great success.

About 0·1 gram of cadmium is dissolved in dilute sulphuric acid, 6 c.c. of formic acid of sp. gr. 1·2 is added, and then solution of potassium carbonate until a slight turbidity is produced. This is removed by a little more formic acid; finally 1 c.c. more of this acid is added, and the mixture is diluted to 150 c.c. and submitted to electrolysis.

L. DE K.

Distribution of the Precious Metals and Impurities in Copper, and Suggestions for a Rational Mode of Sampling. By EDWARD KELLER (*J. Amer. Chem. Soc.*, 1897, **19**, 243—258).—In order to get a fair sample of unrefined copper, plates from 8 to 10 inches square and 1 inch thick should be cast, and from these drillings should be taken at least 1 inch from the edge through the entire plate.

The author believes that when, on the solidification of a metal, the small amounts of impurities segregate or liquate, and consequently concentrate towards the centre, the degree of concentration is greatest for those whose atomic volumes show the greatest difference as compared with that of the metal in which these impurities are present.

L. DE K.

Quantitative Electrolysis of Heavy Metals. By L. WOLMAN (*Zeit. Elektrochem.*, 1897, **3**, 537—545).—The author gives the results of comparative trials of the principal electrolytic methods which have been proposed for the determination of the heavy metals.

Copper.—The best results are obtained with solutions in dilute sulphuric or nitric acid. Solutions containing ammonium oxalate require more time and attention, and from ammoniacal solutions the metal is apt to separate in the spongy condition.

Silver is easily precipitated at 50° from solutions containing 2 to 3 per cent. by volume of nitric acid (sp. gr. 1·36) or from solutions containing potassium cyanide.

Lead is best determined at 50° in solutions containing about 20 per cent. by volume of nitric acid (sp. gr. 1·36). The peroxide precipitate must be dried at 180—190°.

Manganese.—Fairly good results are obtained with solutions containing 1 to 1·5 per cent. by volume of strong nitric acid, using a very small current and warming to 50°. Solutions in potassium oxalate, acetic acid or ammonium pyrophosphate do not give satisfactory deposits.

Zinc is best deposited from strongly alkaline solution at 50° by means of a fairly strong current. Potassium or ammonium oxalate solutions are also satisfactory, but acetic or citric acids, ammonium acetate, potassium cyanide, or ammonium pyrophosphate are unsatisfactory.

Cobalt and nickel are best deposited from ammoniacal solutions; Classen's ammonium oxalate and Brand's ammonium pyrophosphate methods give good deposits, but somewhat high numbers.

Iron is deposited slowly but completely from solutions in ammonium oxalate.

Copper may be separated from zinc or nickel by first depositing the copper from an acid solution.

Zinc and nickel are separated by first depositing the zinc from an alkaline solution containing Rochelle salt. If the electrolysis is too long continued, the zinc is apt to contain nickel.

Zinc and cadmium are separated accurately by precipitating the latter at 50° with a feeble current from a solution containing 1 or 2 per cent. by volume of dilute sulphuric acid.

Lead is separated from zinc, copper, or silver by precipitating it at the anode from a solution strongly acidified with nitric acid. In the case of silver, however, the lead peroxide contains some silver, and the silver deposit simultaneously formed at the cathode is spongy. Copper is not completely precipitated from the strongly acid solution.

Copper and silver are separated by employing an E. M. F. lower than that required to deposit copper, namely, 1·3 to 1·5 volts. The process is slow, so that it is easier to precipitate the silver as chloride.

T. E.

Detection and Estimation of Traces of Lead in Waters. By J. C. BERNTROP (*Chem. Zeit.*, 1896, 1020).—The author has found that lead phosphate is absolutely insoluble in water containing free sodium phosphate, and utilises this fact for the detection and estimation of lead in drinking waters.

A few litres of the sample is, if necessary, rendered somewhat hard by adding calcium chloride, and excess of sodium phosphate is then added. The precipitate which forms during 24 hours contains all the lead. It is collected on a filter, and after being dissolved in nitric acid, the lead is recovered from the solution and identified by the usual methods.

L. DE K.

Estimation of Lead in Lead Ores. By RICHARD K. MEADE (*J. Amer. Chem. Soc.*, 1897, 19, 374—377).—The author recommends the following process. About 1 gram of the sample is treated in a platinum dish with 50 c.c. of a mixture of concentrated sulphuric and nitric acids (1 : 3). The dish is covered and heated on a sand-bath until the action of the acid has ceased. The cover is then removed, rinsed into the dish, and 15 c.c. of hydrofluoric acid added, the dish being heated until fumes of sulphuric acid begin to make their appearance. When cold, the residue is diluted to about 100 c.c., and the undissolved lead sulphate is collected and washed first with a 2 per cent. solution of sulphuric acid and then with alcohol. The precipitate is detached from the filter and ignited, the paper being burnt separately in the usual way.

If a sample of galena should contain calcite, this may be removed by a preliminary treatment of the ore with dilute hydrochloric acid, but it is always advisable to wash the lead sulphate thoroughly with acidified water in order to remove the last traces of calcium sulphate.

L. DE K.

Volumetric Estimation of Lead. By J. HOWARD WAINWRIGHT (*J. Amer. Chem. Soc.*, 1897, 19, 389—393).—The author recommends a process differing but slightly from that given in Crookes' "Select Methods." To estimate the amount of metallic lead in litharge, 1 gram of the sample is dissolved in 10 c.c. of nitric acid (sp. gr. 1·20), the solution is neutralised with excess of ammonia, and a large excess of acetic acid is added; the liquid is then heated to boiling and a solution of potassium dichromate run in from a delicate burette until the bulk of the lead has been precipitated. The dichromate solution should be made of such a strength that 1 c.c. represents a quantity of lead not greatly differing from 0·01 gram. The solution is now again boiled until the lead chromate has become orange coloured, and the titration is then cautiously continued until the precipitate settles promptly. The dichromate is now added a drop at the time, until a few drops of the supernatant liquid put on to a white porcelain tile gives a distinct red coloration with a drop of a 2 per cent. solution of silver nitrate.

Other metals which are precipitated by potassium dichromate or which exercise a reducing action on it should be first removed. Red lead should be dissolved in dilute nitric acid with the addition of oxalic acid; white lead may be at once dissolved in acetic acid.

L. DE K.

Sodium Peroxide as a Third [Iron-zinc] Group Reagent.—By SAMUEL W. PARR (*J. Amer. Chem. Soc.*, 1897, **19**, 341—348).—The metals of this group may be, to some extent, separated by means of aqueous potash or soda; but in the presence of chromium, the separation is far from complete, as this metal is partly retained by the precipitate, particularly in the presence of zinc.

The author recommends dissolving the ammonium sulphide precipitate in nitric acid, and after neutralising with soda, heating the solution with excess of sodium peroxide. The chromium will then be converted into sodium chromate, and the other metals, except zinc and aluminium, will be left insoluble as hydroxides, or peroxides; they are usually free from phosphoric acid. L. DE K.

Estimation of Manganese in Iron Ores in the Dry Way. By BÜTTGENBACH (*Chem. Centr.*, 1896, ii, 1134; from *Rev. Univers.*; *Berg.-Hüttenm.-Zeit.*, **55**, 368).—Two fusions are made; the one with an acid flux, the other with a basic flux The regulus of the former contains only the iron of the ore, the slag containing the manganese as silicate. The regulus of the latter contains the iron with the reducible manganese, and its excess of weight over the former should agree with the excess of weight found in the slag of the acid fusion (allowing for the oxygen required to form manganous oxide). Should they not agree, the difference is due to the non-reduction of part of the manganese in the ore, in consequence of a deficiency in the amount of iron present. Ores rich in manganese can be smelted without the addition of lime; the regulus then contains the iron free from manganese and containing only traces of carbon. M. J. S.

Estimation of Manganese by Electrolysis. By CARL ENGELS (*Zeit. Elektrochem.*, 1897, **3**, 286—289, and 305—308).—Further details are given of the method previously described (Abstr., 1896, ii, 276), of determining manganese by depositing it electrolytically as peroxide from solutions containing chrome alum, or alcohol and ammonium acetate.

Manganates and permanganates are first reduced by a small excess of hydrogen peroxide in acetic acid solution, the hydrogen peroxide destroyed by a little chromic acid, the ammonium acetate and chrome alum added, and the free acetic acid neutralised by ammonia; the solution is then electrolysed in an etched platinum basin at about 80°, and the adherent deposit thus obtained is heated for 3 or 4 minutes to redness to convert it into Mn_3O_4. With 0·4 gram of manganese in 150 c.c. of solution containing 2 grams of chrome alum and 10 grams of ammonium acetate, the precipitation is complete in about 1¼ hours with a current density of 0·8 to 1 ampère per sq. dcm. The results of the test analyses given are excellent.

Heavy metals must first be removed when they occur along with manganese, and when the filtrate from them is dilute or contains substances which would interfere with the electrolytic separation, the manganese is best precipitated with hydrogen peroxide and ammonia, and then redissolved and treated as above described.

The determinations can be made with smaller currents, but the time required is correspondingly longer. At ordinary temperatures, 1·25 volts and at 80° 1·1 volts are sufficient to produce decomposition, but in the cold the precipitation is complete only after a very prolonged action of the current, and the precipitate is brittle and does not adhere well to the dish. In order to obtain a sufficiently adhesive precipitate, the electrolysis must be conducted at 80° and in presence of chrome alum; the latter may be replaced by alcohol, though this is less certain in its results, and requires the application of at least 2 volts. The reason of the variations in the properties of the precipitate is discussed at length; the author considers that MnO_2 and Mn_2O_3 are the primary products of the electrolysis, and that they are deposited as a brittle, metal-like coating. If, however, oxygen is simultaneously separated at the anode, it is supposed to act, in the nascent state, as a reducing agent, rendering the coating porous and not brittle. The chrome alum acts partly by reducing the manganese peroxide, partly by taking up some of the oxygen and so modifying the evolution of gas that the coating is not mechanically disturbed. The inferior results obtained with alcohol are due to the fact that it merely acts in the second way and not in the first.

With a current density of 0·8 to 1 ampère per sq. decimetre and with 0·2 to 0·3 gram of manganese, the quantity of chrome alum employed may be varied from 1 to 3 grams; with larger or smaller quantities, the deposit of manganese peroxide is brittle and non-adhesive.

T. E.

Estimation of Iron in Limestones. By Désiré de Paepe (*Chem. Zeit.*, 1896, **20**, 1004).—5 to 10 grams of the sample is boiled for 5 minutes with strong hydrochloric acid, some water added, and the liquid filtered; after the addition of nitric acid, the mixture is boiled, and the iron and alumina are precipitated by ammonia, collected on a filter, and washed. The filtrate is made up to a definite volume, and may then be used for the estimation of lime, magnesia, alkalis, &c. The ferric precipitate is dissolved in hydrochloric acid, diluted to 125 c.c., and an aliquot portion mixed with excess of tartaric acid; the iron is then precipitated with ammonia and ammonium sulphide, the precipitate being finally converted into ferric oxide. L. de K.

Qualitative Separations with Sodium Nitrite in Absence of Phosphates. By GILLET WYNKOOP (*J. Amer. Chem. Soc.*, 1897, **19**, 434—436).—The author states that iron, chromium, and aluminium may be completely separated from zinc, manganese, cobalt and nickel by adding to the solution, if necessary, a few drops of hydrochloric acid and then boiling with excess of sodium nitrite. It is advisable to first reduce the iron to the ferrous state, as it then gives a more granular precipitate.

The author's test experiments, although only qualitative, are perfectly satisfactory. L. DE K.

Electrolytic Separation of Nickel and Cobalt from Iron. By O. DUCRU (*Compt. rend.*, 1897, **125**, 436—439).—When a solution containing a ferric and a nickel salt is precipitated with excess of ammonia, part of the nickel is precipitated and part remains in solution, but if an electric current is passed through the liquid in which the precipitate is suspended, the whole of the nickel is deposited on the cathode. A very small quantity of iron is deposited at the same time, and a correction must be made by dissolving the metal and precipitating the iron after peroxidation; for practical purposes, however, the correction, which is always small, is rarely necessary.

The metal is dissolved, the solution evaporated to dryness with a slight excess of sulphuric acid, the residue dissolved in water, mixed with 5 to 10 grams of ammonium sulphate, heated, placed in the electrolysis apparatus, mixed with excess of concentrated ammonia, and subjected to the action of a current of 1·5 to 2·5 ampères for about 4 hours. The results quoted in the paper indicate that the method is very accurate.

In the case of steels, 0·25 to 0·30 gram is dissolved in aqua regia, evaporated with sulphuric acid, and treated as above.

It is not necessary to separate the silicon and carbon, and traces of manganese, chromium, and phosphorus do not affect the accuracy of the estimation. Traces of manganese are almost always deposited with the small quantity of iron, but the error due to this cause is negligable.

The author notes that a small portion of the metal deposited is insoluble in hydrochloric acid, but dissolves in aqua regia, and the latter solution gives the reactions of ferric salts.

Small quantities of chromic acid prevent the precipitation of the nickel by electrolysis from the ammoniacal solutions. C. H. B.

Estimation of Molybdenum Iodometrically. By FRANK A. GOOCH (*Amer. J. Sci.*, 1897, [iii], 237—240, and *Zeit. anorg. Chem.*, **14**, 317—322).—The author defends his process (Abstr., 1897, ii, 76) against the criticisms of Friedheim and Euler, and states that the results they obtained are vitiated by serious arithmetical errors.

L. DE K.

Analysis of Commercial Calcium Carbide and Acetylene, and Purification of the Latter. By GEORG LUNGE and EDWARD CEDERCREUTZ (*Zeit. angw. Chem.*, 1897, 651—655).—The authors point out the great difficulty there is in obtaining a thoroughly representative sample on account of the impossibility of obtaining a fine powder without moisture being absorbed and acetylene given off. About 50—100 grams of pea-sized lumps must therefore be taken for analysis; these are placed in a generating flask and brine is slowly added through a tap funnel until effervescence ceases; the gas is collected in a large gasometer over brine, or, better still, over water previously saturated with the gas. One hundred grams of chemically pure calcium carbide should yield 34·877 litres of gas at normal temperature and pressure.

Frequently the sample contains phosphorus, which is evolved as hydrogen phosphide, and sulphur which is partially given off as hydrogen sulphide and volatile sulphur compounds. To estimate these, 50—70 grams of the sample is treated as directed above, and the gases allowed to pass through a ten-bulb absorption tube filled with 75 c.c. of a 3 per cent. solution of sodium hypochlorite. This oxidises the phosphorus and sulphur to the corresponding acids; after precipitating the first with ammoniacal magnesium chloride, the second may be precipitated in the filtrate by adding hydrochloric acid and barium chloride.

Commercial acetylene may be purified by passing it first through a milk of chloride of lime, or, better still, over moist lumps of that substance. This treatment fully removes phosphorus and sulphur compounds. It may then be both dried and freed from ammonia by passing it through sulphuric acid of 1·6 sp. gr. L. DE K.

Estimation of Cyanogen by Silver Nitrate, using Potassium Iodide and Ammonia as Indicators. By WILLIAM J. SHARWOOD (*J. Amer. Chem. Soc.*, 1897, **19**, 400—434).—The author, after criticising the various processes in use, recommends the following scheme. To the solution containing the cyanogen, 5 c.c. of ammonia and 2 c.c. of a 5 per cent. solution of potassium iodide are added, and then standard solution of silver nitrate until a faint, permanent cloudiness is produced. If the solution contains sulphides in small amount, 5—10 c.c. of a solution made by dissolving 0·5 gram of iodine and 2 grams of potassium iodide in 100 c.c. of water is used in place of the potassium iodide, but a special check should be made in such case. If the amount of sulphide is large, it must be removed by means of a solution of sodium plumbite; an aliquot part of the filtrate is then titrated.

If zinc is present, a large excess of alkali should be added; in this case, the cyanogen found represents, not only the potassium cyanide, but also the double zinc compound. By estimating the zinc, the amount of free potassium cyanide may be readily calculated, as 1 part of zinc corresponds with 4 parts of potassium cyanide. A similar allowance must be made if small quantities of copper are present. If calcium, magnesium, or manganese are present, ammonium chloride must be added, whilst soda is used in presence of aluminium or lead.

For technical purposes, it is best to prepare a silver nitrate solution containing 1·305 grams of this salt per 100 c.c.; taking samples of 10 c.c. each, 1 c.c. of the silver represents 0·1 per cent. of potassium cyanide. L. DE K.

Detection of Rhodinol in Ethereal Oils. By HUGO ERDMANN and P. HUTH (*J. pr. Chem.*, [ii], 56, 27—42). See this vol., i, 36.

Recalculation of Wein's Table for Starch Estimation. By WILLIAM H. KRUG (*J. Amer. Chem. Soc.*, 1897, **19**, 452—454).—Wein has constructed a very useful table for calculating the amount of starch or dextrin from the amount of metallic copper obtained when employing Allihn's process for the estimation of starch. This table is based on the factor 0·90. There being some slight difference of opinion regarding the true molecular formula of starch, Ost states that the factor 0·925 should have been employed.

The author has, therefore, recalculated the table, using the average factor 0·92. L. DE K.

Estimation of Carbohydrates in Food-stuffs. By WINTHROP E. STONE (*J. Amer. Soc.*, 1897, **19**, 183—197; 347—349).—The author has worked out a scheme for the estimation of carbohydrates in food-stuffs, as the methods generally employed are becoming obsolete, and do not satisfy the present demands.

In the author's process, the sample is finely ground or grated, and from 50 to 100 grams is first extracted, preferably in a Soxhlet apparatus, with 500 c.c. of strong alcohol to dissolve out any sugars; the residue is then exhausted with 500 c.c. of cold water to remove dextrin and soluble starch, and the undissolved part is air-dried. Two grams of the latter is boiled with 100 c.c. of water for half an hour, and, after cooling to 65°, it is digested with diastase at this temperature, in order to hydrolyse the starch. The residue left after this treatment is then boiled in a reflux apparatus with 100 c.c. of water and 2 c.c. of hydrochloric acid, to convert the gums, pentosans, hemicelluloses, &c., into reducing sugars; finally, the residue is boiled with aqueous soda (1·25 per cent.), and the crude fibre which is left is dried and weighed. L. DE K.

Improvements on Squibb's Volumetric Method for Estimating Acetone. By LYMAN F. KEBLER (*J. Amer. Chem. Soc.*, 1897, **19**, 316—320).—The process differs from the original method (Abstr., 1897, ii, 466) in so far that the use of pure acetone and the drop end-reaction are dispensed with. The following solutions are required: 1. A 6 per cent. solution of hydrochloric acid. 2. A decinormal solution of sodium thiosulphate. 3. An alkaline solution of potassium iodide made by dissolving 250 grams of the pure salt, making the liquid up to 1 litre, and adding 800 c.c. of aqueous soda containing 257 grams of soda per litre. 4. An approximately four-fifths normal solution of sodium hypochlorite, made by mixing 100 grams of 35 per cent. chloride of lime with 400 c.c. of water, and adding a solution of 120 grams of soda crystals in 400 c.c. of hot water; when cold, the clear liquid is decanted, diluted to 1 litre, and mixed with 25 c.c. of aqueous soda of sp. gr. 1·29. 5. A starch solution made by rubbing 0·125 gram of starch with 5 c.c. of cold water and then adding 20 c.c. of boiling water and again boiling for a few minutes; when cold, 2 grams of sodium hydrogen carbonate is added. The sample of acetone to be tested should be diluted with water to 50 or 100 times its weight. Twenty c.c. of the solution 3 is put into a stoppered flask, 10 c.c. of the acetone solution is added, and excess of solution 4 run in from a burette. After thoroughly shaking, the mixture is rendered acid by adding solution 1, excess of solution 2 is run in, and after a few minutes a little of solution 5 is added and the excess of thiosulphate re-titrated.

A blank experiment without the acetone having been made, the percentage of the latter can be readily calculated by remembering that 1 mol. of acetone requires 3 mols. of free iodine to form iodoform.

L. de K.

Estimation of all the Volatile Fatty Acids in Butter. By Eduard Wrampelmeyer (*Landw. Versuchs.-Stat.*, 1897, **49**, 215—218).—The filtered fat (about 5 grams) is heated in a 700—800 c.c. flask with 20 c.c. of glycerol sodium hydroxide (prepared by dissolving 100 grams of caustic soda in 100 c.c. of water and mixing 20 c.c. of the solution with 180 c.c. of glycerol) over a flame until frothing ceases and the liquid is clear. 250 c.c. of hot, boiled distilled water is carefully added, then a drop of indicator (litmus), and finally 50 c.c. of dilute sulphuric acid (20 c.c. of acid sp. gr. = 1·84 to 1 litre). The flask is immediately closed with a double bored cork fitted with a bulb-tube connected with a condenser at least 0·5 metre long, and a second tube for steam distillation. For the production of steam, boiled distilled water is employed, and the steam is passed through a connecting tube of copper (30 cm. long and 1·4 cm. wide) which is well heated with a flat burner. The distillation of 1·5 litres (collected in two portions of 1 and 0·5 litre) takes about an hour and a half. The distillate is filtered and half in each case (500 c.c. and 250 c.c. respectively) titrated.

All the water used in the process must be previously boiled to remove carbonic anhydride. In order to avoid any substance being mechanically carried over in the distillation, the bulb of the distilling tube must have a bent tube at the upper opening. Check experiments must be made with each apparatus, and potash must not be substituted for soda.

N. H. J. M.

Estimation of Lactic and Succinic Acids in Wines. By Joseph A. Muller (*Bull. Soc. Chim.*, 1896, [iii], **15**, 1203—1206).—The succinic and lactic acids in wines are usually estimated together and expressed in terms of the equivalent quantity of sulphuric acid, but they can readily be separated by taking advantage of the fact that barium succinate is almost completely insoluble in alcohol of 80—83°, whereas barium lactate dissolves. The wine is mixed with quartz sand, evaporated to dryness under low pressure, and the residue dried over potash. It is then extracted with ether, the ether distilled off or allowed to evaporate spontaneously, the residue dissolved in water and the hot solution titrated with carefully purified barium hydroxide solution, using phenolphthalein as indicator. The neutral liquid is evaporated to dryness, mixed with 5 c.c. of warm water and 25 c.c. of absolute alcohol, and allowed to remain for several hours, after which it is filtered, the residue washed with alcohol of 80°, and the barium estimated in both the residue and the solution. Experiments made with liquids of known composition indicate that the results are too low in the case of both acids, the error being greater in the case of the lactic acid, by reason of its volatility (compare this vol., i, 9).

C. H. B.

Estimation of the Acidity of Milk. By ARTHUR DEVARDA (*Chem. Centr.*, 1896, ii, 1003; from *Österr. Molkerei-Zeit.*, 1896, Sept.).—The author uses a stoppered flask holding 100 c.c. to the bottom of the neck, and with a cylindrical neck of 6 c.c. capacity graduated in half cubic centimetres. One hundred c.c. of milk, together with the necessary amount of 4 per cent. alcoholic phenolphthalein solution, reach to the zero mark, and when sufficient N/10 alkali has been added to produce the red colour, the reading on the neck gives at once the degree of acidity; 5 c.c. of alkali corresponds with 1 Soxhlet degree.

M. J. S.

Detection of Filicic Acid in Cases of Poisoning by Fern Extract. By ICARO BOCCHI (*Chem. Centr.*, 1896, ii, 1137; from *Boll. Chim. Farm.*, 1896, 20, 609).—The viscera are cut up, dried on the water bath, and extracted with a mixture of 1 part of absolute alcohol and 3 parts of ether; the extract is then evaporated, the greenish-brown residue treated with lime-water until a colourless solution is obtained, and the filtered solution acidified with acetic acid and shaken with carbon bisulphide. The residue from the bisulphide solution may be further purified by dissolving it in ether, and treating the solution with lime-water or neutral cupric acetate; the usual tests for filicic acid can then be applied. Filicic acid does not pass into the urine, but is decomposed in the organism.

M. J. S.

Analysis of Linseed Oil and Linseed Oil Varnish. By WALTHER LIPPERT (*Zeit. angw. Chem.*, 1897, 655—657. Compare Abstr., 1897, ii, 529).—A criticism of Amsel's so-called water test for ascertaining the presence of rosin and rosin oil in linseed oil. This test consists in saponifying the sample with alcoholic potash and then adding water, when in the presence of adulterants a more or less decided turbidity will be noticed.

The author proves the test to be utterly untrustworthy.

L. DE K.

Examination of Resins. By KARL DIETERICH (*Chem. Centr.*, 1896, ii, 1137—1139; from *Ber. deut. pharm. Ges.*, 6, 247).—*Peru balsam.*—To obtain the saponification number, 1 gram is digested in the cold for 24 hours with 50 c.c. of light petroleum and 50 c.c. of N/2 alcoholic potash; 300 c.c. of water is then added and the liquid titrated with acid. The normal value is 260—270. For ascertaining the acid number, a dilution of 1 : 200 is necessary. Phenolphthalein should be added repeatedly and the titration continued until the supernatant liquid shows a distinct red colour after the brown, flocculent precipitate has subsided; values of 68—80 are obtained, whilst adulterations raise the acid number and lower the saponification number. The ether number, obtained by subtracting the acid number from the saponification number, varied only from 188 to 196 in the specimens examined by the author. Commercial samples contain 1·5—3 per cent. insoluble in ether. The ethereal solution serves for the estimation of the cinnamein and the resin salts (peruresinotannol cinnamate), for which purpose it is shaken with 20 c.c. of a 2 per cent. solution of sodium hydroxide, and the two liquids carefully separated. Evaporation of the ethereal solution gives the cinnamein, and precipitation of the alkaline solution with hydrochloric acid the resin. The former should amount to 65—75 per cent., and the latter to 20—28 per cent. of the balsam.

Gum Ammoniacum.—The acid number is obtained by distilling 0·5 gram in a current of steam and conveying the distillate directly into 40 c.c. of N/2 potash. To test for galbanum resin, 5 grams is boiled with 15 grams of strong hydrochloric acid for 15 minutes, 15 c.c. of water is added, and the liquid filtered through a wetted, double filter; the clear filtrate is supersaturated with ammonia, when a blue fluorescence reveals the presence of galbanum. In estimating the saponification number, heat must be avoided. The following fractional method gives the resin number and gum number. Two quantities of 1 gram each are digested for 24 hours in stoppered flasks with 50 c.c. of light petroleum and 25 c.c. of normal alcoholic potash; one quantity is then diluted with 500 c.c. of water and titrated with N/2 sulphuric acid, which gives the resin number; whilst to the other, 25 c.c. of N/2 aqueous potash and 75 c.c. of water are added, and after another 24 hours the mixture is titrated as before, giving the saponification number. The difference is the gum number. A good specimen should show high acid and resin numbers, and a low gum number. M. J. S.

Detection and Estimation of Santonin in the Flower Buds of Artemisia maritima. By K. Thaeter (*Arch. Pharm.*, 1897, **235**, 401—414).—To estimate the quantity of santonin, the flowers are extracted with ether, the residue left on evaporating the ether is digested with milk of lime, the filtrate treated with aluminium acetate, excess of magnesia added, and the thoroughly dried mass again extracted with pure anhydrous ether. Three different kinds yielded 2·26, 2·43, and 2·78 per cent. of santonin respectively. The author finds that Kippenberger's method (*Ber. deutsch. pharm. Ges.*, 4), recommended by Thomas (*Zeit. anal. Chem.*, **34**, 294), is not generally applicable owing to the extreme difficulty of extracting santonin by means of glycerol containing tannin.

Tannin precipitates santonin from aqueous but not from alcoholic solutions. With sulphuric acid alone, santonin does not give any coloration, but it is easily detected by means of furfuraldehyde sulphuric acid, with which it gives first a carmine-red coloration on warming, becoming bluish-violet, and finally dark blue; after prolonged digestion, a black precipitate is formed. By this means 0·0001 gram may easily be detected. The author has compared the effects of this test on a large number of alkaloids, bitter principles, glucosides, &c., but only the following gave characteristic colour reactions. α-Naphthol gives first a carmine-red and then a violet coloration which persists for an hour. β-Naphthol turns orange and then cherry-red. Veratrine gives various colours—green, red, blue—becoming violet, and finally brown; and with sulphuric acid alone a yellow, then carmine-red, and finally a brown colour. Picrotoxin with furfuraldehyde sulphuric acid produces a very persistent violet, and piperine a light-green coloration, passing through sea-green to bluish-green and indigo blue. With sulphuric acid alone, the latter gives a reddish-yellow coloration which becomes brown on warming. E. W. W.

Caffeine. By GUILFORD L. SPENCER (*J. Amer. Chem. Soc.*, 1897, **19**, 279—281).—The author prefers estimating caffeine in tea by means of Gomberg's volumetric iodine method (Abstr., 1897, i, 129), instead of the gravimetric process. To obtain a suitable solution, 5 grams of finely ground tea is boiled for half an hour with about 400 c.c. of water; a considerable excess of recently prepared iron hydroxide is added, and after digesting for an hour the liquid is cooled and diluted to 500 c.c. An aliquot part is then filtered off and titrated by Gomberg's method. L. DE K.

Modification of the Thalleioquinine Test for Quinine. By F. S. HYDE (*J. Amer. Chem. Soc.*, 1897, **19**, 331—332).—Some of the suspected alkaloid (0·003—0·005 gram) is dissolved in 5 c.c. of water with the aid of one drop of dilute sulphuric acid (1 : 4), and a clear solution of bleaching powder is added until the blue fluorescence has just disappeared; a few drops of dilute ammonia (1 : 3) are then added, when a clear, emerald-green coloration should appear. This is more certain than the ordinary method of testing with chlorine or bromine water and ammonia. L. DE K.

Behaviour of Proteids with Aldehydes. By ERNST O. BECKMANN with H. SCHARFENBERGER GEN. SERTZ and O. ELSNER (*Chem. Centr.*, 1896, ii, 930—932).—See this vol., i, 55.

Estimation of Albumin in Urine. By WASSILÉEFF (*Chem. Centr.*, 1896, ii, 1012; from *St. Petersb. Wochenschr.*, 1896, 331).—For gravimetric estimation, the urine is mixed with 4 volumes of 95 per cent. alcohol, and the vessel immersed for 3—5 minutes in hot water. The precipitate is then collected, dried, weighed, and its ash (which never exceeds 1 per cent.) subtracted. For clinical purposes, albumin in urine can be titrated with salicylsulphonic acid. 10—20 c.c. of urine (acidified with acetic acid if alkaline) is diluted with water, mixed with 2 drops of a 1 per cent. aqueous solution of "Fast Yellow" (Echtgelb), and titrated with a 25 per cent. solution of salicylsulphonic acid until a permanent brick-red colour is obtained. One c.c. precipitates 0·01006 gram of albumin, and even at a dilution of 1 : 50000 produces a distinct turbidity. M. J. S.

General and Physical Chemistry.

Validity of Maxwell's Equations. By P. S. Wedell-Wedellsborg (*Zeit. physikal. Chem.*, 1897, **24**, 367—370).—Known facts are, in the author's opinion, not in accord with Maxwell's equations, the validity of which is contested, for according to these equations, there must be, at the starting of a current, two induction effects: (1) that experimentally obtained; (2) that due to the increase of the electrostatic field. The paper also contains the author's reply to some of Goldhammer's criticisms of a previous paper on this subject (*Zeit. physikal. Chem.*, **23**, 686). L. M. J.

Laboratory Notes. By William Skey (*Chem. News*, 1897, **76**, 109).—In the following couples, the electrolytes were separated by gelatin. With gold in potassium cyanide, and platinum in an acid, hydrogen is evolved from the platinum, but if an alkali is substituted for the acid, this is not the case. With gold or silver in cyanide, and gold or silver in copper sulphate, copper is deposited. With platinum or gold in tannic acid, and potash and platinum or gold in acid, a strong current is developed, and hydrogen is evolved until all the tannic acid is oxidised. Platinum in potash is positive to platinum in acid or ferrous sulphate, and throws down gold or platinum or silver from solution. Platinum in concentrated salt solution rendered alkaline with potash, and platinum in acid also throws down gold, from its chloride, on platinum and produces a strong current. An insulated voltaic cell connected with insulated silver plates 6 inches square and an inch apart in the air develops a current too feeble for detection by the galvanometer, but deposits gold, from its chloride, on platinum. D. A. L.

Thermodynamics of "Swelling" ("Quellung"), with Special Reference to Starch and the Determination of its Molecular Weight. By Hermann Rodewald (*Zeit. physikal. Chem.*, 1897, **24**, 193—218. Compare Abstr., 1895, i, 165).—The author applies the term "swelling" to the absorption of water, or other liquid, by a solid substance which does not exhibit any pores, visible or microscopic. An expression is deduced thermodynamically for the heat liberated in terms of the change of specific volume, namely, (1) $\gamma = T[dp/dt(s' - s -)y]$, and the author then records the experimental work for the case of starch. Air-dried starch was found to contain about 16·33 per cent. of moisture, and the heat produced by soaking in water was observed for starches of different original water content, an ice-calorimeter being employed; a curve and table of the results are added. The contraction in volume was also obtained as a function of the percentage of water, the curve being very similar to the above heat curve. The values of dp/dt and y in the equation (1) are deduced from the values of the heat and volume change for the dry and moist starch, and the expression $\gamma = 273(s' - s)1{\cdot}75 - 0{\cdot}00507$ is thus obtained. A relation between the volume change, hence the heat of swelling, and the water content is next calculated, from which the equation $\log(s' - s) = 0{\cdot}8 - 2 - 0{\cdot}0423w$ is obtained, and hence $\gamma = 0$ when $w = 31{\cdot}63$. By means of an expression used by Kirchhoff for the vapour pressure of sulphuric acid solutions, that of the starch is calculated, the value thus obtained being 4·5594 for 31·63 per cent. of water; from this calculated value of the vapour pressure, the author deduces the number 4370 for the molecular weight of starch corresponding with the formula $C_{162}H_{270}O_{135}$. The expansion coefficient was found to be a linear function of the water, and the force of attraction between dry starch and moisture is calculated as 2073 kilos. per sq. cm. L. M. J.

Distillation with Vapour. By C. H. Benedict (*J. Physical Chem.*, 1897, **1**, 397—402).—The author finds that there is an enormous increase in the volatility of solid naphthalene when ether is present. Distillation with a current of ether vapour would give not less than four times as much naphthalene as if the process were carried on with an air current or under diminished external pressure. Some rough measurements with camphor in different solvents gave similar results.

H. C.

Solubility of Solids in Vapours. By J. M. Talmadge (*J. Physical Chem.*, 1897, **1**, 547—554).—The author distilled saturated solutions of camphor and naphthalene in methylic alcohol, ethylic alcohol, acetone, and ether under different pressures, an excess of the solid being present in all cases. In the case of naphthalene, he was unable to confirm Benedict's result (see preceding abstract), and although the experiments show that the concentration of naphthalene vapour in equilibrium with solid naphthalene is not independent of the other components in the system, they do not show whether the vapour pressure is increased or decreased by the presence of a solvent. In the case of camphor, the vapour pressure of the solute also varies with the solvent. The values with ether and acetone are more than double the real vapour pressures. With methylic alcohol, the values are a little above the normal, whilst with ethylic alcohol, the calculated vapour pressures are only about one-half of those obtained directly. H. C.

Temperature of Maximum Density of Barium Chloride Solutions. By Louis C. de Coppet (*Compt. rend.*, 1897, **125**, 533).—The following results were obtained.

Weight of $BaCl_2$ in 1000 grams of water.	Temperature of maximum density.	Reduction of the temperature of maximum density.	Molecular reduction of temperature of maximum density.
0	3·982°	—	—
6·73	3·207	0·775°	23·94
10·42	2·785	1·197	23·88
20·83	1·572	2·409	24·04
41·72	−0·843	4·825	24·04

The reduction of the temperature of maximum density is sensibly proportional to the weight of anhydrous barium chloride dissolved in 1000 grams of water. C. H. B.

Solubilities of Liquids. By A. Aignan and E. Dugas (*Compt. rend.*, 1897, **125**, 498—500).—Mixtures of acetic acid and benzene in various proportions become homogeneous at different temperatures.

Acetic acid	30 c.c.	40 c.c.	50 c.c.	60 c.c.	70 c.c.
Benzene...........	70 c.c.	60 c.c.	50 c.c.	40 c.c.	30 c.c.
Temperature of homogeneity	102°	75°	50°	30°	2·5°

and in these cases it is difficult to decide which is the solvent and which the dissolved substance, as in the case of aniline, phenol and water described by Alexéeff (Abstr., 1886, 847), and his method of observation does not admit of the solution of the problem.

If V_a and V_b are the respective volumes of the two liquids A and B introduced into the sealed glass tube, α and β their coefficients of reciprocal solubility, and V_1 and V_2 the respective volumes of the two layers of liquid, A saturated with B and B saturated with A,

$$\frac{V_1}{V_2} = \frac{1+\beta}{1+\alpha} \cdot \frac{V_a - \alpha V_b}{V_b - \beta V_a},$$

and a similar relation holds good if weights are taken instead of volumes. When the temperature varies, if α tends towards the value V_a/V_b, the numerator of the first member V_1 should tend towards zero; but if β tends towards the value V_a/V_b, then V_2 should tend towards zero. It becomes necessary, therefore, to observe towards which extremity of the tube the surface of separation of the liquids disappears on heating.

In the cases quoted, with 30, 40, or 50 per cent. of acetic acid, the surface of separation tends towards the bottom of the tube, and hence at 75° and 50° saturated solutions of acetic acid in benzene occur; with 60 and 70 per cent. of acetic acid, the surface of separation tends to disappear towards the upper part of the tube, and hence at 30° and 2·5° saturated solutions of benzene in acetic acid occur.

The authors criticise Alexéeff's method of drawing his curves, which they regard as based on an erroneous assumption.

C. H. B.

Kinetic Theory of Solutions. By Arthur A. Noyes (*Zeit. physikal. Chem.*, 1897, **24**, 366).—In his paper on osmotic pressure (Abstr., 1897, ii, 395), the author erroneously ascribed an inaccurate expression to Nernst.

L. M. J.

Osmotic Pressure and Variance. By Joseph E. Trevor (*J. Physical Chem.*, 1897, 1, 349—365).—The variance is always the total number of variables which a system exhibits, diminished by the number r of its phases. The variables are n potentials, being at least one for each independently variable component, one for the temperature, and one for at least one pressure, with x for the added pressures introduced by the appearance of x osmotic walls, and y for each of the y separations of a component by such a wall. The total number of variables is, therefore, $n+2+x+y$, and the variance is $v=n+2+x+y-r$. This is the generalised phase rule as applicable to all systems containing osmotic pressures. For the limiting case in which all osmotic walls are absent, we have both $x=0$ and $y=0$, and consequently the Gibbs' variance of $v=n+2-r$.

H. C.

Variance of Osmotic Systems. By JOSEPH E. TREVOR (*J. physical Chem.*, 1897, 1, 537—541).—The author shows how it is possible to realise for two component monovariant systems the anticipated set of five curves of osmotic pressures, and their intersection at a five-fold multiple point (compare preceding abstract). H. C.

The Phase Rule and the Physical Properties of Chemical Compounds. By F. WALD (*Zeit. physikal. Chem.*, 1897, **24**, 315—324).—The author discusses the well-known phase-law of Gibbs, namely, $v = n + 2 - r$, where r is the number of phases, v the number of independent variations, and n that of the independent components, two physical conditions only changing. The case chiefly considered is that for an equal number of phases and components, and the author regards it as proved that a number of physical relations "may be deduced between the substances entering into a reaction, especially Gay Lussac's gas law of rational volume ratios." L. M. J.

Quintuple Points. By WILDER D. BANCROFT (*J. Physical Chem.*, 1897, 1, 337—343).—In a system composed of two salts and water there will be in equilibrium at the quintuple points three solid phases, solution, and vapour. The various quintuple points can be classified under three heads.

I. Two of the solid phases can be made from the third with addition or subtraction of water.

II. One of the solid phases can be transformed into one of the others by addition or subtraction of water.

III. No one of the solid phases can be converted into either of the others by addition or subtraction of water.

When one of the solid phases can change into the other two with addition or subtraction of water, the inversion point is a minimum temperature for that phase if the water be added to complete the reaction, and a maximum if the water be subtracted. If one of the solid phases can be converted into one of the others by addition of water, the inversion point is a maximum or a minimum temperature for one of those phases, and is neither a maximum nor a minimum for the third solid phase. When no one of the solid phases can be converted into either of the others by addition or subtraction of water, no prediction can be made. There cannot be in equilibrium three solid phases such that one can be made from the other two without addition or subtraction of water. H. C.

Solids and Vapours. By WILDER D. BANCROFT (*J. Physical Chem.*, 1897, 1, 344—348).—Whilst many salts in efflorescing at constant temperature form all intermediate hydrates, this is not always the case. For example, $Na_2SO_4 + 10H_2O$ changes normally to the anhydrous salt without formation of $Na_2SO_4 + 7H_2O$. If we start with hydrated sodium sulphate, solution, and vapour, and raise the temperature to about 33°, the anhydrous salt will be formed. On decreasing the external pressure, the solution will disappear, leaving the stable monovariant system, hydrated and anhydrous sodium sulphate and vapour. Decreasing the pressure yet more, $Na_2SO_4 + 10H_2O$ must effloresce with formation of the anhydrous salt. Were it to form the heptahydrated salt, there would be present a non-variant system. This would also be formed from the monovariant system at any other temperature at which the latter could exist, and we should thus have the phenomenon of a non-variant system existing at a series of temperatures and pressures, which is impossible according to the phase rule. From this it follows that a solid phase containing two components effloresces with formation of the solid phase which can co-exist at the next higher quadruple point. Two solid phases containing three components effloresce with formation of the solid phase which can co-exist at the next higher quintuple point. From a study of the efflorescence products, one can draw conclusions as to the phases existing at the quintuple points. H. C.

A Triangular Diagram [to represent Composition-Temperature Changes]. By WILDER D. BANCROFT (*J. Physical Chem.*, 1897, 1, 403—410).—A diagram consisting of an equilateral triangle with lines ruled parallel to each side, instead of perpendicular to them, was proposed by Roozeboom for the representation of the changes in composition of a given phase with the temperature when there are three components. The author points out some geometrical relations connected with the use of this diagram. H. C.

Two Liquid Phases. By WILDER D. BANCROFT (*J. Physical Chem.*, 1897, 1, 414—425).—The author considers the general case of quintuple points with two solid phases, two liquid phases and vapour, formed by adding a component C to two components A and B such that there can be formed the quadruple point, solid A, two solutions, and vapour. The general results are.

1. The component C dissolves in B with precipitation of A. The freezing point rises. The solid phases at the quintuple point are A and C or else no non-variant system with two liquid phases is possible.

2. The component C dissolves in A with precipitation of B. The freezing point falls. There is one quintuple point with A and C as solid phases, or two with A and B, B and C as solid phases, or one with A and B as solid phases.

3. The component C increases the miscibility of A and B; the freezing point falls. There is one quintuple point with A and C as solid phases, or one with A and B as solid phases, or there is formed the divariant system, solid A, solution, and vapour.

4. If the component C dissolves in A with precipitation of B and there are two quintuple points, the one with B and C as solid phases will exist at a higher temperature than the one with A and B as solid phases.

5. If the component C increases the miscibility of A and B and there are two quintuple points, the one with B and C as solid phases exists at a lower temperature than the one with A and B as solid phases. H. C.

Solubility and Freezing Point. By DOUGLAS MCINTOSH (*J. Physical Chem.*, 1897, 1, 474—492).—When we have two non-miscible substances A and C and a third substance B with which the other two are miscible we can distinguish two cases.

In the first case, the component A can exist as solid phase under the conditions of the experiment. Under these circumstances, addition of C to the liquid phase containing A and B will raise the temperature at which A can exist as solid phase. In other words, addition of a substance to a binary solution in equilibrium with a solid phase raises the freezing point if the substance added be non-miscible with the component appearing as solid phase. This is shown to be the case for an alcohol-benzene solution to which water is added.

In the second case, the component B can exist as solid phase under the conditions of the experiment. Under these circumstances, addition of B to the liquid phase containing A and B will lower the temperature at which B can exist as solid phase, and this lowering will be more than it would be if A and C were miscible to some extent. When the three components are miscible, the sum of the single depressions is usually greater than the depression for the mixture; but this is not always true, owing to disturbing conditions which are not yet defined. H. C.

Mass Law Studies, II., III. By S. F. Taylor (*J. Physical Chem.*, 1897, 1, 461—473 and 542—546).—In order to study a case in which two liquid phases and a vapour phase are present, the author has analysed six mixtures of benzene, water, and alcohol. The general form of the relations for this system is deduced from the mass law, and it is shown that one must use mass concentrations and not volume concentrations in expressing the distribution of a substance between two liquid phases. Agreement of theory and experiment is obtained in the case studied, and the theory is also successfully applied to the system chloroform, water, and acetic acid. H. C.

Hydrolytic Dissociation. By Heinrich Ley (*Ber.*, 1897, 30, 2192—2196).—The author makes a preliminary communication of results obtained in an investigation of the hydrolysis of salts in aqueous solution. The concentration of the hydrogen ions is determined by measuring the velocity of inversion of cane-sugar by the salt solution at 100°. The following numbers were obtained with solutions of aluminium chloride containing 1 gram equivalent in v litres, p being the percentage hydrolysed.

v.	p.	v.	p.
32	8·8	256	28·7
64	13·8	512	41·8
128	20·1		

Aluminium sulphate is hydrolysed to a smaller extent.

Zinc chloride and sulphate exhibit a similar relationship, the latter salt undergoes very little dissociation, the hydrolysis reaching 0·03 per cent. in 1/16 normal solution.

Lead and copper chlorides gave abnormal results, the rate of inversion of the sugar increasing with the duration of the experiment.

Mercuric chloride could not be examined by this method, because it is reduced by sugar. By assuming that its electrical conductivity is entirely due to the hydrochloric acid produced by its hydrolysis, an upper limit for the latter is obtained varying from 0·29 per cent. in 1/16 normal to 1·64 per cent. in 1/256 normal solution.

The addition of potassium chloride to a solution of aluminium chloride diminishes the hydrolytic dissociation of the latter. The same is true of other salts; the acid reaction of solutions of lead or mercuric chloride disappears when sodium or potassium chloride is added to them. T. E.

Formation of Anilides. By HEINRICH GOLDSCHMIDT and CURT WACHS (*Zeit. physikal. Chem.*, 1897, **24**, 353—365).—It has been shown by Goldschmidt and Reinders that, in solutions of aniline salts in aniline, the salt is probably decomposed into acid and base (Abstr., 1896, ii, 556), a part of the acid being further dissociated. The formation of an anilide is hence analogous to that of an ethereal salt, that is, should be a bimolecular reaction unless a strong acid be added, in which case it becomes monomolecular with velocity proportional to the concentration of the catalysing acid (Abstr., 1896, ii, 638). Experiments with aniline and acetic or propionic acid, and with orthotoluidine and acetic acid showed the reaction to be bimolecular; on the addition of picric, hydrochloric, or hydrobromic acid, it becomes monomolecular, the velocity being accelerated, and proportional to the concentration of the strong acid if sufficiently great. The reaction being bimolecular is not a proof of the non-occurrence of autocatalysis as stated by Donnan (Abstr., 1897, ii, 15) since, if x is the quantity of acid converted into anilide, then $(a-x)$ is the concentration of the acid, and is also proportional to the concentration of the hydrogen ions, so that the velocity is proportional to $(a-x)^2$. The analogy of these solutions to those of hydrated salts is again noticed, and the view that, in solution, the latter are present as anhydrides thus receives support. L. M. J.

Genesis of Dalton's Atomic Theory. By HEINRICH DEBUS (*Zeit. physikal. Chem.*, 1897, **24**, 325—352).—The author upholds his previously published views (Abstr., 1896, ii, 639) regarding the origin of Dalton's theory, that is, that Avogadro's law was held and employed by Dalton, who definitely states that in 1801 he had a "confused idea" that all molecules were of equal size; hence that $M/d=k$. He, moreover, made frequent use of this hypothesis; thus the ratio of the atomic weights of oxygen and nitrogen was fixed at 6/7 from the consideration of their densities, whilst, further, of the gases nitric oxide, nitrous oxide, and "nitric acid," the first has the lowest density and therefore consists "of but two atoms," and since "nitric acid" is heavier than nitrous oxide, it follows that "an atom of oxygen is heavier than an atom of nitrogen." The author points out that this reasoning is entirely dependent on the assumption that the "atomic" (that is, molecular) weight is proportional to the density; in other words, that $M/d=k$. Other similar cases occur, but the apparent failure of this mode of calculation in the case of the hydrocarbons, due to erroneous ideas regarding their composition, ultimately led Dalton to abandon this hypothesis as not of general, although of frequent, application. The second part of the paper is entirely a review, criticism, and refutation of various passages in the reply of Roscoe and Harden to the previous paper (*Zeit. physikal. Chem.*, **22**, 241).

L. M. J.

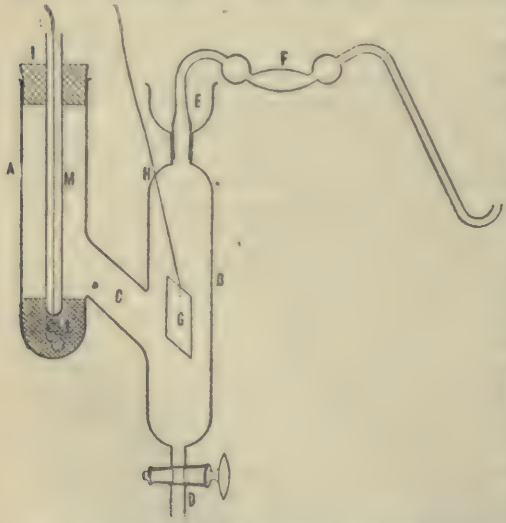
Lecture Apparatus. By William R. E. Hodgkinson (*Chem. News*, 1897, **76**, 152).—Volumemeter. A cylindrical vessel of 100 c.c. capacity provided with a deep and broad, hollow, tubulated stopper is connected at its lower end, by a narrow tube having a stopcock, with a graduated tube. It is filled with the liquid to be used from the zero of the graduated tube to a mark made on the tube of the stopper. After the liquid has been driven into the graduated tube, the stopper is carefully removed, the substance whose volume is to be measured introduced, the stopper replaced, and the liquid brought back to the mark on the stopper. The volume of the substance can now be read off on the graduated tube.

For showing that hot water boils in a closed flask when cold water is poured over it, an improved form of apparatus is described consisting of a fractionating flask with a stopcock sealed on the side tube, and a wide thermometer, wedged by a rubber ring in the neck, with its bulb just dipping into the hot water.

D. A. L.

Inorganic Chemistry.

New Form of the Hydrogen Generator. By E. W. Magruder (*Amer. Chem., J.*, 1897, **19**, 810—812).—The apparatus consists of a tube A, closed at the bottom, and connected by means of the inclined side tube C, with the tube B, furnished at the bottom with the stopcock D, and at the top with the funnel E, into which fits, with a ground joint, the delivery-tube F. B also contains a platinum electrode G, suspended by a platinum wire fused through the tube at H. Zinc amalgam is put into A until it nearly reaches the tube C, A being then closed with a rubber stopper I, carrying a glass tube M, containing a platinum wire, fused through the tube at L and dipping into the amalgam. The apparatus may be simplified by leaving out the stopcock D, and fusing F directly to the top of B.



As the oxygen and hydrogen electrodes are in separate tubes, oxygen or any other escaping gas simply rises to the surface in A, and does not, therefore, mix with the hydrogen.

By having the amalgam nearly up to the side tube, the zinc sulphate formed flows into B, from which it can be drawn off through the stopcock. The generated gas is perfectly pure hydrogen. A. W. C.

Nascent Hydrogen. By Donato Tommasi (*J. Physical. Chem.*, 1897, 1, 555).—A priority claim in connection with Franchot's work on nascent hydrogen (Abstr., 1897, ii, 138).

Wilder D. Bancroft (*ibid.*, 1897, 1, 556) replies by pointing out that Franchot's work had not reached the point at which one would naturally make a reference to Tommasi. H. C.

Heat of Dissociation of Iodine. By Joachim Sperber (*Zeit. anorg. Chem.*, 1897, **15**, 281—282).—The heat of dissociation of iodine, calculated according to the author's theory (Abstr., 1897, ii, 307), is 13·132 Cal.; he points out that this is in close agreement with the number obtained by Boltzmann, namely, 14·265 Cal. E. C. R.

Evolution of Oxygen during Reduction. By K. Frenzel, S. Fritz and Victor Meyer (*Ber.*, 1897, **30**, 2515—2519. Compare Abstr., 1897, ii, 19, 93; this vol. ii, 19).—Erdmann (Abstr., 1897, ii, 97) has attempted to explain the evolution of oxygen during the reduction of rubidium dioxide by hydrogen by the intermediate formation of hydrogen peroxide; in order to test this, experiments were made in some of which such formation was impossible. Potassium peroxide yields no oxygen when heated to the softening point of glass (in a silver vessel) in a current of air. In carbonic oxide, carbonic anhydride, and hydrogen, on the other hand, it gives a considerable amount of oxygen at the boiling point of sulphur. In the cases of carbonic oxide and anhydride, the intermediate formation of hydrogen peroxide is excluded, and it is probable that the three reactions are quite analogous.

$$K_2O_4 + CO = K_2CO_3 + O_2.$$
$$2K_2O_4 + 2CO_2 = 2K_2CO_3 + 3O_2.$$
$$K_2O_4 + H_2 = 2KOH + O_2.$$

Silver oxide decomposes in a current of air at 250°, but when heated at the boiling point of water in hydrogen, it yields free oxygen, and does this even at the ordinary temperature in carbonic oxide; this is due to the fact that the heat evolved by the reduction of a portion of the oxide is so great as to raise the temperature of the rest above the point of decomposition. Similar results were obtained with potassium permanganate, which decomposes in air at 218°, and in hydrogen to a very small extent at 155°, freely at 182°. No evolution of oxygen was observed during the reduction of barium peroxide. A. H.

Solubility of Ammonia in Water at Temperatures below 0°. By John W. Mallet (*Amer. Chem. J.*, 1897, **19**, 804—809).—On passing gaseous ammonia into an already strong aqueous solution at temperatures below 0°, the following results were obtained.

At	−10°	1 gram of water	dissolves	1·115	grams of	ammonia
,,	−20	,,	,,	1·768	,,	,,
,,	−30	,,	,,	2·781	,,	,,
,,	−40	,,	,,	2·946	,,	,,

No visible change marks the presence of enough ammonia to represent the hydroxide of ammonium, assumed to exist in ordinary solution, and the hydroxide, if it exists, continues to dissolve ammonia, or mixes with liquefied ammonia down to and beyond the normal boiling point of the latter.

The proportion of ammonia dissolved by water is much greater than would be called for by an extension of the curve representing the solubility at temperatures above 0°. A. W. C.

Chloronitrides of Phosphorus. II. By HENRY N. STOKES (*Amer. Chem. J.*, 1897, **19**, 782—796. Compare Abstr., 1895, ii, 217).—Continuing his researches on the chloronitrides of phosphorus, the author finds they are best prepared by heating phosphorus pentachloride and ammonium chloride, in molecular proportion, in sealed tubes, $PCl_5 + NH_4Cl = PNCl_2 + 4HCl$. The operation requires to be conducted with great caution on account of the large amount of hydrogen chloride generated. There is formed a mixture of chloronitrides, which is partly crystalline and soluble in light petroleum, and partly liquid and insoluble in this solvent; the latter portion consists of about 50 per cent. $P_3N_3Cl_6$ and 25 per cent. $P_4N_4Cl_8$, the remainder consisting of the higher homologues. A separation is effected by means of fractional distillation, and, in the case of the solids, crystallisation from benzene.

The series, as at present known, consists of the following.

	Melting point.	Boiling point.	
		13 mm.	760 mm.
Triphosphonitrilic chloride, $(PNCl_2)_3$	114°	127°	256·5°
Tetraphosphonitrilic chloride, $(PNCl_2)_4$	123·5°	188°	328·5°
Pentaphosphonitrilic chloride, $(PNCl_2)_5$	40·5—41°	223—224·3°	polymerises
Hexaphosphonitrilic chloride, $(PNCl_2)_6$	91°	261—263°	polymerises
Heptaphosphonitrilic chloride, $(PNCl_2)_7$	liquid at −18°	289—294°	polymerises
Polyphosphonitrilic chloride, $(PNCl_2)_x$	below red heat	depolymerises on distillation	

There were obtained, further, a liquid residue of the same empirical composition with a mean molecular weight of $(PNCl_2)_{11}$ and a small amount of *nitrilohexaphosphonitrilic chloride*, $P_6N_7Cl_9$, not belonging to the above series. It melts at 237·5° (corr.) and boils at 251—261° (13 mm.), crystallises in transparent rhombic prisms, often united to acicular forms, and when pulverised becomes electrified.

The complete absence of the lower members of the above series

$PNCl_2$ and $(PNCl_2)_2$ is very remarkable. Each member of the series is converted by heat into the caoutchouc-like polyphosphonitrilic chloride, which is highly elastic and insoluble in all neutral solvents. It swells enormously in benzene, and on heating breaks down into a mixture of all the lower members mentioned above. A. W. C.

Migrant Matter. By STEPHEN H. EMMENS and NEWTON W. EMMENS (*Chem. News*, 1897, **76**, 37).—Minute variations in weight observed in little discs, one of silver and one of lead (free from silver), suspended in air in a bottle and both in contact with the same spiral of copper wire are attributed to migration of matter. On cupellation, the lead now showed a minute amount of silver. D. A. L.

Valency of Beryllium. By ARTHUR ROSENHEIM and PAUL WOGE, (*Zeit. anorg. Chem.*, 1897, **15**, 283—318). Hydrated beryllium oxide, when treated with solutions of oxalic acid and hydrogen alkali oxalates, yields a series of double salts and not complex compounds as in the case of the hydrated oxides of chromium, iron, and aluminium. When treated with hydrogen alkali tartrates, it yields a series of complex compounds of the formula $R_2O,4BeO,2C_4H_4O_5 + 8H_2O$, in which beryllium displaces the hydroxyl hydrogen atom of the tartaric acid. When treated with salts of paramolybdic acid, it yields beryllium molybdate, $BeO,MoO_3 + 2H_2O$, and with hydrogen alkali sulphites it yields characteristic crystalline double salts. All these reactions point to the conclusion that beryllium is bivalent; and the determination of the molecular weight of beryllium chloride by Beckmann's boiling point method, using pyridine as the solvent, gives numbers which agree closely with the formula $BeCl_2$.

The *double* salts, $K_2O,2BeO,2C_2O_3 + 2\frac{1}{2}H_2O$; $Na_2O,2BeO,2C_2O_3 + 5H_2O$, and $(NH_4)_2O,2BeO,2C_2O_3 + 2\frac{1}{2}H_2O$, are obtained by treating a boiling solution of potassium, sodium, and ammonium oxalate respectively with hydrated beryllium oxide. The potassium salt separates in lustrous crystals, the sodium salt, which is very soluble, in ill-defined crystals, and the ammonium salt in slender needles; the two former are stable on exposure to the air, but the ammonium salt is extremely hygroscopic. Oxalic acid and beryllium can be detected in solutions of these salts by the ordinary methods.

The *salts* $K_2O,BeO,2C_2O_3 + H_2O$; $Na_2O,BeO,2C_2O_3 + H_2O$, and $(NH_4)_2O,BeO,2C_2O_3$ are obtained by saturating solutions of the corresponding hydrogen alkali oxalates with hydrated beryllium oxide, and then adding an equal quantity of the hydrogen alkali oxalate. When treated with calcium or barium chloride, they are quantitatively decomposed into calcium or barium oxalate and beryllium chloride. When boiling oxalic acid is saturated with hydrated beryllium oxide, a non-crystallisable syrup is obtained containing 1 mol. of oxalic anhydride to 2·5—3 mols. beryllium oxide; if to this solution an equal quantity of oxalic acid is added, *beryllium oxalate*, $BeOC_2O_3 + 3H_2O$, separates in needles, which are obtained in quadratic tablets on recrystallisation from water. The *acid oxalate*, $2BeO,3C_2O_3 + 6H_2O$, is obtained by dissolving 1 mol. of beryllium oxide in 2 mols. of oxalic acid. It crystallises in beautiful prisms.

The *complex tartrates*, $K_2O,4BeO,2C_4H_4O_5 + 8H_2O$, the sodium salt with $8H_2O$, and the ammonium salt with $8H_2O$, are obtained by saturating a boiling aqueous solution of the corresponding hydrogen, alkali tartrate with hydrated beryllium oxide. The potassium salt, which is extremely soluble, crystallises in large, lustrous prisms, the sodium and ammonium salts in microcrystalline crusts; the beryllium in these salts is at once precipitated by ammonia. However, the complex character of the salts is shown in the abnormal behaviour of the tartaric acid. Potassium chloride does not cause a precipitation of potassium tartrate, even on adding dilute acids; no precipitate is obtained with calcium chloride, and barium chloride gives a precipitate only after some time. With neutral silver nitrate, a flocculent, voluminous precipitate is at once formed. All the salts are neutral to ordinary indicators.

These salts are the first compounds isolated in which a metal is substituted for, not only the carboxyl hydrogen atom, but also for the hydroxyl hydrogen atom of the tartaric acid.

The *salt* $K_2O,2BeO,2C_4H_4O_6 + 2H_2O$, obtained by dissolving the theoretical quantity of hydrated beryllium oxide in a solution of hydrogen potassium tartrate, forms a glassy, crystalline mass, and has properties similar to those of the preceding beryllium tartrates; it is strictly analogous to the copper compound of Fehling's solution.

Beryllium molybdate, $BeOMoO_3 + 2H_2O$, obtained by boiling the theoretical quantity of hydrated beryllium oxide with molybdic acid suspended in water, is an oily liquid which solidifies to an aggregate of slender needles if kept for some time in the cold.

The complex compounds corresponding with those obtained by saturating potassium or sodium paramolybdate with sesquioxides cannot be obtained in the case of beryllium oxide, beryllium paramolybdate being always formed. With ammonium paramolybdate, beryllium molybdate is usually formed, but in some cases the double salt, $10(2BeO,MoO_3) + 2(NH_4)_2O,3MoO_3 + 18H_2O$ is obtained, crystallising in microcrystalline crusts

The *double* salts, $K_2O,2BeO,3SO_2 + 9H_2O$ and

$$(NH_4)_2O,2BeO,3SO_2 + 4H_2O,$$

are prepared by digesting freshly prepared solutions of the hydrogen alkali sulphites with hydrated beryllium oxide on the water bath; the solutions, which must contain excess of sulphurous acid, yield crystals of the salts on cooling. They are extremely easily oxidised, and when exposed to the air rapidly evolve sulphurous anhydride, ammonium sulphite being also formed. E. C. R.

Potassium Lead Iodide. By J. M. TALMADGE (*J. Physical Chem.*, 1897, 1, 493—498).—Schreinemakers (Abstr., 1893, ii, 260) has shown that concentration at ordinary temperatures of a solution from which the solid double salt $PbI_2,KI + 2H_2O$ has separated is always attended by solution of the double salt. The author shows that, at 100°, the behaviour is reversed and there is continued precipitation of the double salt on evaporation. H. C.

Cuprous Chloride. By J. K. HAYWOOD (*J. Physical Chem.*, 1897, 1, 411—413).—Lescœur has shown that when cuprous chloride is treated with water, cuprous oxide and hydrochloric acid are formed, and states that when cuprous chloride is washed with water, the amount of acid in the wash water remains practically constant until all the cuprous chloride has been converted into oxide. The author shows that this last result must have been obtained by accident, as the action is dependent on time and the mass of water present. H. C.

Possible New Element or Elements in Cast Iron and Blast-furnace Boiler-Dust. By GETHEN G. BOUCHER (*Chem. News.*, 1897, **76**, 99—100 ; 182).—The suspected new metal has been obtained from iron to the extent of from 0·0019 to 0·006 per cent., in the following manner. The iron is treated with dilute 1 : 5 sulphuric acid and the cold solution saturated with hydrogen sulphide. The mixed precipitate and undissolved matter, after being washed until free from iron, is boiled with hydrochloric acid and potassium chlorate until the evolution of chlorine ceases, and the filtered solution is saturated with hydrogen sulphide. The precipitate is again submitted to the treatment with hydrochloric acid and potassium chlorate ; the arsenic precipitated by magnesia mixture and filtered off ; the copper, by treatment with hydrogen sulphide, precipitated as sulphide, which is removed, and the solution slightly acidified with hydrochloric acid. The precipitate is repeatedly boiled with hydrochloric acid to remove antimony sulphide and a heavy dark-brown sulphide remains. This is dissolved in potash, the solution treated with hydrogen sulphide, filtered, and reprecipitated with hydrochloric acid, these operations being repeated until no further precipitate is obtained from the alkaline solution on treatment with hydrogen sulphide. The sulphide is dissolved in hot (1 : 2) nitric acid, the solutions filtered, made slightly alkaline with ammonia, any precipitate removed, and the metal again precipitated as sulphide.

The *metal* is obtained as a black powder by reducing the oxide in a current of hydrogen, or by fusion with potassium cyanide ; it is insoluble in dilute hydrochloric and sulphuric acids, sparingly soluble in these acids when strong, is soluble in dilute and strong nitric acid, and very readily soluble in aqua regia. When heated in a current of air, the metal glows and forms a yellow, volatile oxide. The *oxide*, which is also formed on roasting the sulphide, melts at a low temperature and sublimes at a full red heat, yielding transparent, colourless needles ; it is sparingly soluble in hydrochloric acid, almost insoluble in sulphuric acid, and insoluble in nitric acid. The borax bead is clear and colourless in the outer, and pale pink in the inner, flame, the microcosmic salt beads are chrome-green, that in the inner flame being darker. When fused with sodium carbonate, the oxide yields a colourless mass soluble in water. The *sulphide*, precipitated from slightly acid solutions by hydrogen sulphide, is dark-brown, and soluble in the sulphides of ammonia and sodium and in the alkali hydroxides, also in nitric acid and aqua regia, but insoluble in dilute hydrochloric and sulphuric acids. The solution of the chloride gives the following reactions : with sodium thiosulphate, a violet coloration, turning brown on heating with hydrochloric acid and yielding a precipitate of the sulphide ; with potassium ferricyanide, a dark brown, flocculent precipitate soluble in acids and alkalis ; with alkali hydroxides, a slight blue coloration, with zinc or iron, a black deposit of metal, some of which escapes with the evolved hydrogen; and when deposited in the usual way from the flame, is almost black with little lustre, and neither soluble in hydrochloric acid nor calcium hypochlorite. No reactions, however, are obtained with carbonates, chlorides, sodium sulphate, phosphate or acetate, magnesia mixture, potassium cyanide, ferrocyanide or chromate, ferrous sulphate or stannous chloride. The chloride or nitrate when evaporated nearly to dryness with hydrochloric or, better still, sulphuric acid, gives a blue coloration destroyed by water. It does not give a precipitate when warmed with sodium phosphate and nitric acid.

Heavy, dark-coloured boiler-dust yields a metal that is similar in all respects except that, with stannous chloride, it produces a dark blue colour, turning brown when boiled with hydrochloric acid. The strong aqueous extract of the dust is treated with hydrogen sulphide and hydrochloric acid, the precipitate, when sufficient has been accumulated, is dissolved in aqua regia and evaporated nearly to dryness with sulphuric acid; the solution is diluted, filtered, made alkaline with ammonia, treated with hydrogen sulphide, filtered, and acidified with hydrochloric acid. The precipitated sulphide is dissolved in potash and treated as in the preceding case. A ton of dust yielded 0·3 gram of this metal. D. A. L.

Lucium. By WALDRON SHAPLEIGH (*Chem. News*, 1897, **76**, 41).—Following Barrière's methods, but making each separation thoroughly, the author did not obtain lucium from monazite, but, instead, less than 1 per cent. of mixed oxides of the yttria group. He remarks that concentrated solutions of yttrium potassium sulphate give a precipitate when heated, and suggests that this may be the origin of Barrière's lucium, inasmuch as Barrière used concentrated solutions, and then heated (compare Crookes, Abstr., 1897, ii, 144). D. A. L.

Action of Carbonic Anhydride on Sodium Aluminate. Formation of Basic Aluminium Carbonate. By WILLIAM C. DAY (*Amer. Chem. J.*, 1897, **19**, 707—728).—When carbonic anhydride is passed into a solution of sodium aluminate (prepared from "Connetable" phosphate rock by the action of quicklime and sodium carbonate, and subsequent washing), a precipitate is formed which differs from aluminium hydroxide precipitated from an aluminium salt by means of ammonium hydroxide in being of an opaque white, and more granular. If this precipitate is washed with cold water until the washings show no alkaline reaction, and the air-dried residue is analysed, it is found to contain more carbonic anhydride (from 5·5—9 per cent.) than is capable of uniting with the small amount of sodium present.

The author concludes that this substance must be regarded as a basic aluminium carbonate. The literature bearing on this subject is discussed at some length. A. W. C.

[Reactions of Titanic Acid with Organic Acids.] By GEORG BERG (*Zeit. anorg. Chem.*, 1897, **15**, 328—330).—See this vol., i, 66.

Platino-platinoso-additive Compounds. By MAURICE VÈZES (*Zeit. anorg. Chem.*, 1897, **15**, 278—280).—The author points out that acid potassium triplatinosohexanitrite, $Pt_3O(NO_2)_6K_2H_4$, which he obtained by the cautious oxidation of potassium platinosonitrite, cannot have a constitution analogous to the platinum compounds described by Werner (Abstr., 1896, i, 465) and Hadow (this Journal, 1860, **13**, 106), although it exhibits the same phenomenon, namely, it crystallises in copper-coloured crystals and gives an almost colourless solution in water. The same behaviour is characteristic of the compound obtained by Miolati by heating at 150° the compounds $Pt(NO_2)_4K_2,N_2O_4$ and $Pt(NO_2)_4K_2,HCl$. Miolati states that it is identical with, or analogous to, acid potassium triplatinosohexanitrite. E. C. R.

Mineralogical Chemistry.

Critical Review of Methods of Determining Minerals. By JOSEPH W. RICHARDS (*Chem. News*, 1897, **76**, 114—116, 139—140).—The author comments on Dana's, Weissbach's, Von Kobell's and Fuch's schemes for determining minerals, and concludes that the best scheme should regard the physical properties as *suggestive* before, and *confirmatory* after, the chemical composition, the true *determinative* factor, has been ascertained. By his scheme, the following is the order of tests. (1.) Test metallic and malleable minerals, for metals. (2.) Test specifically light and black minerals, for hydrocarbons. (3.) Test minerals having any taste, for salts. (4.) Test minerals with metallic, adamantine, and resinous lustre, in open tube and otherwise, for sulphur, arsenic, antimony, selenium, tellurium. (5.) Test other minerals for silica, and then test as required, (6) for phosphates and borates, (7) for carbonates, (8) for sulphates, (9) for volatile acids. (10.) Then try open tube tests. (11.) Bead tests for weak acids, chromium, vanadium, &c. (12.) Blowpipe tests. 10, 11 and 12, in some cases, would probably be done in test 4. D. A. L.

Experimental Petrogeny. By KARL B. SCHMUTZ (*Jahrb. f. Min.*, 1897, ii, 124—155).—A summary of this paper has already been given by Doelter (Abstr., 1897, ii, 54; compare also Abstr., 1897, ii, 329). L. J. S.

Amber. By PAUL DAHMS (*Jahrb. f. Min.*, 1897, ii, Ref., 273—274; from *Schriften naturforsch. Ges. Danzig*, 1897, **9**, 1—19).—The commercial clarification of cloudy amber by heating in oil depends on the pores of the amber becoming filled with oil. Mineral and albuminous matters are extracted from the amber, and a little phosphoric acid is taken up from the crude oil. According to the author's determinations, amber contains.

(*a*) A resin soluble in alcohol, with melting point 105°.
(*b*) A resin soluble in ether, but insoluble in alcohol, m. p. 146°.
(*c*) A resin soluble in alcoholic potash, m. p. 175°.
(*d*) Succinin, 44—60 per cent.
(*e*) Succinic acid, 3·2—8·2 per cent.

The soluble portion represents the original balsam of the amber tree, and the succinin is an alteration product of this. In the dry clarification of amber, by heating it in sand for some time, the soluble resins melt and fill the pores; the same result is brought about at the ordinary temperature after a long interval of time. L. J. S.

Minerals from Netherseal Colliery, Leicestershire. [Blende, Ankerite, Galena.] By George J. Binns and George Harrow (*Trans. Fed. Inst. Mining Eng.*, 1897, **13**, 252—255).—The following minerals are found in the coal-measures at Netherseal Colliery, Leicestershire.

Blende, as small, black crystals, lining cracks in bands and nodules of clay-ironstone, gave on analysis

Zn.	Fe.	Ca.	Mg.	Cd.	S.	Total.
63·20	2·11	0·50	0·36	trace ?	33·91	100·08

Ankerite occurs as indistinct rhombohedra, associated with the blende, and also with galena; it is white, but changes to buff on exposure to the air; analysis gave

$CaCO_3$.	$FeCO_3$.	$MgCO_3$.	Gangue.	Total.
53·0	23·3	20·8	1·1	98·2

Galena, from clay filling a fault-fissure, gave

PbS.	FeS.	ZnS.	Gangue.	Total.	Sp. gr.
98·42	0·27	0·41	0·46	99·56	7·39

Hartley and Ramage have detected copper, silver, iron, sodium, and potassium in this galena by spectroscopic methods.

Barytes, calcite, and copper pyrites are also found. L. J. S.

Minerals of the Harz. [Blende, Stibnite, Jamesonite, Orthite, Axinite.] By Otto Luedecke (*Zeit. Kryst. Min.*, 1897, **29**, 176—192).—The author here recapitulates all the original matter contained in his recent book, *Die Minerale des Harzes* (Berlin, 1896); this deals mainly with occurrences and crystallographic determinations. The following new analyses are given.

Blende from Clausthal gave, on analysis by Reinicke,

Zn.	Fe.	Pb.	S.	SiO_2.
64·25	2·25	0·03	33·13	0·51

This gives the ratio (Zn,Fe,Pb) : S = 1 : 0·9.

Stibnite from Wolfsberg was found to contain nothing but antimony and sulphur. It would, therefore, be useful for the determination of the atomic weight of antimony.

Jamesonite, in compact, felty masses of capillary crystals, from Schwenda gave, on analysis by G. Baumert,

Pb.	Sb.	S.	Fe.
49·57	28·53	19·84	0·53

Orthite, in crystals, from quartz veins in gabbro at Bärenstein, gave

SiO_2.	CaO.	MgO.	$(Ce,La,Di)_2O_3$.	$(Al,Mn,Fe)_2O_3$.	Sp. gr.
29·05	5·67	0·52	21·56	29·29	3·784

Axinite, in crystals, from crystalline limestone at Radauthal, gave Baumert results agreeing with the formula $H_4R''_{20}Si_{11}O_{44},R'''_{12}Si_9O_{36}$.

SiO_2.	CaO.	FeO.	MgO.	MnO.	Fe_2O_3.	Al_2O_3.	B_2O_3.	K_2O.	H_2O.
39·26	29·70	3·65	1·81	2·80	2·62	14·46	4·91	0·25	1·22

L. J. S.

Identity of Chalcostibite (Wolfsbergite) and Guejarite. By SAMUEL L. PENFIELD and AUGUST FRENZEL (*Amer. Journ. Sci.*, 1897, **4**, 27—35; and *Zeit. Kryst. Min.*, 1897, **28**, 598).—Chalcostibite was first described, from Wolfsberg, in the Harz, in 1835, as being orthorhombic and having the composition Cu_2S,Sb_2S_3. In 1879, Cumenge (Abstr., 1881, 517) gave the name guejarite to an orthorhombic mineral from Güejar-Sierra, Spain, which had, according to his analysis (I), the composition $Cu_2S,2Sb_2S_3$. The later crystallographic determinations made by Laspeyres (Abstr., 1892, 124) on the Wolfsberg mineral agreed completely with those previously obtained for guejarite; and from a re-examination of Cumenge's original material, the present authors have established the identity of chalcostibite and guejarite which was suggested by this agreement. Analyses by Frenzel, made on measured crystals of "guejarite," gave the results under II, III, and IV, these agreeing closely with the formula Cu_2S,Sb_2S_3, the percentage composition of which is given under VI. For these analyses, every crystal was first qualitatively tested for copper, in order to make certain that no stibnite crystals were present, since this mineral, as noticed by Cumenge himself, closely resembles chalcostibite in colour, lustre, the perfect pinacoidal cleavage, and in crystal habit. The excess of antimony in Cumenge's analysis (I) was probably due to the presence of stibnite.

	I.	II.	III.	IV.	V.	VI.
S	25·0	26·28	—	26·12	26·20	25·87
Sb	58·5	48·86	48·50	48·44	48·45	48·50
Cu	15·5	24·44	25·92	25·23	24·72	25·63
Pb	trace	0·58	—	0·32	—	—
Fe	0·5	0·42	—	0·49	—	—
Zn	—	—	—	0·18	—	—
	99·5	100·58		100·78	99·37	100·00
Sp. gr....	5·03	4·96				

Chalcostibite has recently been found at the Pulacayo mine, Huanchaca, Bolivia, where it occurs with tetrahedrite, pyrites, and quartz. Analysis of crystals gave the results under V (Frenzel). These crystals, being very perfect and rich in terminal planes, have enabled accurate determinations of the crystallographic constants of chalcostibite to be made; Penfield finds $a:b:c = 0·5312:1:0·63955$, the perfect cleavage being taken as parallel to the basal plane, and the elongated striated zone as the macroaxis b. L. J. S.

[Bournonite from Bolivia.] By AUGUST FRENZEL (*Zeit. Kryst. Min.*, 1897, **28**, 607—609).—The veins of the Pulacayo silver mine, at Huanchaca, are in a trachytic quartz-porphyry, and contain the following minerals: quartz, pyrites, tetrahedrite, blende, galena, copper pyrites, rarely stibnite, stephanite, chalcostibite (preceding abstract), and bournonite, together with traces of bismuth and tin compounds. Tetrahedrite is the principal ore; it contains up to 10 per cent. of silver. Bournonite occurs as small, bright, columnar crystals, sometimes embedded in the tetrahedrite; analysis gave

Pb.	Cu.	Ag.	Fe.	Zn.	Sb.	S.	Total.
40·88	12·70	trace	0·40	0·14	24·78	20·50	99·40

L. J. S.

Composition of some Tellurium Minerals. By WILHELM MUTHMANN and E. SCHRÖDER (*Zeit. Kryst. Min.*, 1897, 29, 140—145).—The authors have examined specimens of tetradymite with the idea of determining the amount of selenium which has been shown by several previous analyses to be present in traces. Full details of the methods of analysis are given in the paper. Tetradymite from Orawicza, Hungary, gave I and II, after deducting about 11 per cent. of gangue; it occurs as greyish-white scales with copper pyrites and tetrahedrite in calcite; selenium is absent. Tetradymite in distinct crystals from Schubkau, Hungary, gave III, IV, and V; sp. gr. 7·0946; traces of selenium are present. All these analyses agree with the formula $2Bi_2Te_3,Bi_2S_3 = Bi_2Te_2S$.

	I.	II.	III.	IV.	V.	VI.	VII.
S	4·51	4·47	4·20	4·35	4·39	9·31	9·40
Bi	58·93	59·34	60·36	59·98	60·34	79·31	78·82
Te	35·30	35·56	35·25	35·35	35·68	12·82	12·66
	98·74	99·37	99·81	99·68	100·41	101·44	100·88

A tellurium mineral from Cumberland, analysed by Rammelsberg in 1853, gave VI and VII, corresponding with the formula Bi_4S_3Te or Bi(S,Te). The irregular masses are grey in colour with a metallic lustre, and have a perfect cleavage in one direction. On the cleavage surface, there are cracks intersecting at 60°, and the thermal conductivity figure is a circle, so that the crystal system is rhombohedral as in tetradymite. Sp. gr. 7·321. The formula, in which bismuth is bivalent, is analogous to that of karelinite (Bi_4O_3S). This new mineral is named *grünlingite*. L. J. S.

[Cubic Ferric Oxide] from Stromboli. By ALFRED BERGEAT (*Jahrb. f. Min.*, 1897, ii, 109—123).—The older lavas of the volcanic island of Stromboli, in the Lipari Islands, are andesites, whilst the newer are basaltic in character. A leucite rock, namely, leucite-basanite, is described. Good mineral specimens are rare on the island; besides augite crystals and thin plates of hæmatite, only the following is described.

The mineral, of which the following analysis by Hilgenstock is given, occurs as dull crusts of a dark, blue-grey colour on lava. This crust is composed of small, regular octahedra, often arranged in groups parallel to a cubic axis, and then having the appearance of tetragonal prisms terminated by pyramids. The mineral resembles hæmatite in the colour of the powder, but differs from it in being strongly magnetic. The sp. gr. of the crystals is 4·998, and of the powder, after separating tridymite and plagioclase, 5·247. On fractures, and in thin sections, the crystals are seen to enclose much hæmatite as thin plates arranged parallel to the octahedral faces.

Fe_2O_3.	FeO.	MgO. MnO.	Al_2O_3 (probably from plagioclase).	Gangue.	Total.
94·68	2·67	0·17	0·25	1·48	99·25

This description suggests martite, but the author is inclined to regard the mineral as magnesoferrite (MgO,Fe_2O_3) enclosing much hæmatite. L. J. S.

Precious Stones of New South Wales. By J. MILNE CURRAN (*Journ. and Proc. Roy. Soc. N.S.W.*, 1897, 30 (for 1896), 214—285).—In this paper, which is illustrated by eight plates, the modes of occurrence and characters of all the known precious stones from New South Wales are described. A complete bibliography and historical sketch are added, together with some methods for the discrimination of rough stones.

Diamond is found in the drift at three localities, the most important being Bingara.

Sapphire chiefly occurs in the tin-bearing drifts of the Emmaville and Tingha districts; it has also been found in basalt. Ruby is very rare in the colony.

Emerald occurs near Emmaville in a decomposed felsitic matrix associated with topaz, fluorite, mispickel, cassiterite, &c. Transparent crystals gave, on analysis by J. Petrie,

SiO_2.	Al_2O_3.	BeO.	CaO.	MgO.	Na_2O.	H_2O.	Total.	Sp. gr.
65·20	17·80	14·40	1·00	0·64	0·34	0·62	100·00	2·73

Rare alkalis could not be detected spectroscopically.

Topaz is abundant in the tin-bearing drifts and granites of the northern part of the colony. Analysis of bluish-white, transparent material from Emmaville gave,

SiO_2.	Al_2O_3.	CaO.	F.	Total (less O for F).	Sp. gr.
30·29	60·90	0·40	15·05	100·30	3·50

Garnet is common, but good stones are rare. Red pyrope (anal. I) occurs near Bingara in a basic, holocrystalline, granular rock (anal. II) composed of pyroxene and felspar; the garnet is surrounded by a kelyphite border.

	SiO_2.	Al_2O_3.	Fe_2O_3.	FeO.	MnO.	CaO.	MgO.	K_2O,Na_2O.	H_2O.	Total.	Sp. gr.
I.	39·57	23·68	0·18	10·04	3·76	8·76	14·45	—	—	100·44	3·743
II.	42·4	18·4	10·4	—	trace	16·6	8·5	2·5	1·2	100·0	3·1
III.	49·80	9·90	8·64	—	—	15·80	15·86	—	—	100·00	—

Anal. III is of large phenocrysts of augite from an olivine-basalt dyke containing garnets, from near Harden.

Turquoise occurs as thin crusts and concretionary masses in a dark, carbonaceous shale, containing pyrites, from near Bodalla. It is of a good sky-blue colour, but on exposure becomes greenish owing to loss of water. Analysis gave,

P_2O_5.	Al_2O_3.	Fe_2O_3.	CaO.	CuO.	SiO_2.	H_2O.	Total.	Sp. gr.
31·90	36·236	1·264	1·70	7·45	0·50	21·00	100·05	2·67

Opal is well known from White Cliffs, where it occurs in Upper Cretaceous sandstones; the silica has been derived from beds of organic (diatomaceous and radiolarian) origin.

Zircon, beryl, nephrite, cordierite, serpentine, malachite, and various varieties of quartz are also described. L. J. S.

Pseudogaylussite from Holland. By F. J. P. van Calker *Zeit. Kryst. Min.*, 1897, **28**, 556—572).—Spheroidal groups of crystals, closely resembling the well-known pseudomorphs from Sangerhausen, in Thuringia, and other localities, have been found embedded in alluvial clay at Onderdendam in the province Groningen. The pyramidal crystals are of a yellowish colour, and the surfaces are rough and curved; in the interior, they show a cellular aggregate of differently orientated calcite grains. Analysis shows the presence of 89·9462 per cent. of calcium carbonate.

CaO.	MgO.	Al_2O_3.	Fe_2O_3.	Na_2O.	K_2O.
50·6281	0·5000	1·8657	1·2985	0·2718	0·1086

SiO_2.	CO_2.	SO_3.	Insol. (clay).	H_2O (at 100°).	H_2O (on ignition).	Total.
0·1426	40·4659	0·3689	2·3804	0·7704	1·8011	100·6020

Pseudogaylussite is also recorded from Kwadyk and Friesland in Holland.

A review of the literature of these pseudomorphs is given, and the evidence supplied by the chemical composition and external form discussed. No definite conclusion is arrived at as to what was the original mineral, which has been variously assumed to be gaylussite (Breithaupt, 1836), celestite (Des Cloizeaux, 1843), gypsum (Kenngott, 1870), anhydrite (Groth, 1878), and a hypothetical tetragonal chlorocarbonate of calcium (Dana, 1884). The author has failed to detect strontium by spectroscopic methods; and the presence of a little sodium carbonate and the porous structure of the pseudomorphs seem to suggest that gaylussite was the original mineral. Several measured angles are given, but, owing to the roughness and curvature of the faces, the variations are considerable, and they compare equally well with both gaylussite and celestite. L. J. S.

[Pyromorphite, Mimetite, &c.] from Broken Hill, N.S.W. By Charles W. Marsh (*Trans. Australian Inst. Mining Eng.*, 1897, **4**, 138—159).—*Cerussite* is remarkable for the variety of crystalline aggregates produced by twinning.

Pyromorphite, occurring in crystalline aggregates, gave analyses I—III. A lemon- to orange-yellow variety called "chromo-phosphate" contains some chromic acid as well as arsenic.

	PbO.	P_2O_5.	As_2O_5.	V_2O_5.	Cl.	Total.
I. Brown	81·9	14·4	0·8	—	1·9	99·0
II. White	80·8	14·6	2·3	—	2·2	99·9
III. Straw-yellow......	79·3	13·2	6·2	—	1·1	99·8
IV. Yellow	74·7	1·2	21·4	—	2·8	100·1
V. White	74·2	5·7	17·6	—	2·4	99·9
VI. Red	73·9	1·8	18·2	3·6	2·1	99·6

Mimetite crystals gave analyses IV—VI. The bright yellow is the most pure, sometimes containing only a trace of phosphoric acid; the lighter coloured and greenish specimens contain more phosphoric acid, whilst those coloured red and brown contain vanadium and graduate into vanadinite.

Wulfenite occurs as orange-yellow, orange-red, and deep red crystals, the last containing some chromic acid.

Stolzite occurs as smoky-grey, yellowish, and reddish tetragonal crystals, and in long, thin plates. [The last, of which figures are given, is probably identical with raspite (this vol., ii, 32)].

Several rare minerals are also mentioned as occurring at Broken Hill: namely, hedyphane, phosgenite, lanarkite, leadhillite, matlockite, percylite, linarite, minium, jordanite, sartorite, boulangerite, and jamesonite. Anglesite and galena are also described. L. J. S.

Gypsum Deposits of Nottinghamshire. By ARTHUR T. METCALFE (*Trans. Fed. Inst. Mining Engineers*, 1896, **12**, 107—114).—Bands of gypsum are abundant in the upper marls of the Keuper beds of Nottinghamshire and Derbyshire; it is worked as an ornamental stone, and for the manufacture of plaster of Paris. The composition of an ordinary sample is,

$CaSO_4$.	$CaCO_3$.	Oxide of iron.	Siliceous matter.	H_2O.	Total.
77·37	0·83	0·50	0·30	21·00	100·00

Anhydrite sometimes occurs in the centre of masses of gypsum.
L. J. S.

[Analysis of Soda-mica]. By FRANZ EIGEL (*Zeit. Kryst. Min.*, 1897, **29**, 169; from *Jahresber. des F. B. Gymnasiums am Seckauer Diöcesan-Knabenseminar*, for 1894—5).—White mica from a "sericite-mica-schist" consisting essentially of quartz and mica, from near Pöllau, Styria, gave, on analysis,

SiO_2.	Al_2O_3.	CaO.	Na_2O.	K_2O.	H_2O.	Total.
51·43	32·11	trace	11·80	1·29	5·67	102·30

The optic axial angle is large. The amount of soda is much higher than shown in any previous analysis. L. J. S.

Composition of Comendite. By SOLIMANN BERTOLIO (*Jahrb. f. Min.*, 1897, ii, Ref. 292; from *Rend. R. Accad. Lincei*, 1896, [v], **5**, (2), 150—152. Compare Abstr., 1897, ii, 55).—The ægirite-liparite from S. Pietro in Sardinia has been called comendite; a specimen richer in alkalis, and with less quartz than usual, gave analysis I. Sp. gr. 2·57. Some of the felspar is schillerised, but still clear; analysis II shows it to be anorthoclase; sp. gr. 2·58—2·59. The amphibole, which resembles arfvedsonite, gave III; sp. gr. 3·33.

	SiO_2.	Al_2O_3.	Fe_2O_3.	FeO.	MnO.	CaO.	MgO.	K_2O.	Na_2O.	Total.
I.	68·5	14·5	1·0	3·0	—	trace	0·1	3·0	9·2	99·3
II.	66·1	18·2	trace		—	0·1	—	3·5	11·4	99·3
III.	49·10	5·50	4·20	27·70	0·50	0·13	0·17	1·60	10·50	99·40

L. J. S.

Sodalite-trachyte from the Siebengebirge. By WILLY BRUHNS (*Verh. naturhist. Ver. Bonn*, 1896, **35**, 39—56).—The peculiar rock from Kühlsbrunnen, in the Siebengebirge, has often been described and is usually called an ægirite-trachyte; it is now shown to contain sodalite, to which the cellular structure of the weathered rock is due. In the fresh rock, the sodalite is present in clear, colourless, isotropic grains; it dissolves easily in dilute nitric acid, yielding a clear solution, without any separation of gelatinous silica. The portion of the rock soluble in dilute acid gave analysis I; besides sodalite, this would only include a little glass and magnetite. A partial analysis (II) of the augite needles confirms the reference, made on optical grounds, to ægirite. The felspar is all sanidine; magnetite is abundant, and a glassy base is rare; analysis of the fresh rock gave the results under III.

	SiO_2.	Al_2O_3.	Fe_2O_3.	FeO.	MnO.	CaO.	MgO.	K_2O.	Na_2O.	Cl.	Loss on ignition.	Total.
I.	34·2	31·2	trace	—	—	nil.	nil.	nil.	27·9	7·5	—	100·8
II.	—	2	28	not det.	—	little		nil.	10	—	—	—
III.	63·61	16·34	4·30	2·08	trace	1·42	0·37	5·54	6·21	0·18	0·77	100·82

Detailed descriptions and analyses are given of trachytes from other localities, which were examined on account of their similarity in appearance to the Kühlsbrunnen rock; no sodalite was, however, found in these. L. J. S.

Contact-metamorphism of Phyllites. By K. DALMER (*Jahrb. f. Min.*, 1897, ii, 156—158).—At Schneeberg, in Saxony, a phyllite composed of 24·93 per cent. of chlorite and 75·07 of muscovite has been altered into a rock containing andalusite 31·1, muscovite and biotite 68·9 per cent.; the two rocks, as shown by analyses I and II respectively, have essentially the same composition.

	SiO_2.	Al_2O_3.	Fe_2O_3.	FeO.	MgO.	CaO.	K_2O.	Na_2O.	H_2O.
I.	39·49	34·47	5·86	5·74	1·85	0·25	5·38	1·17	5·78
II.	39·00	34·85	6·18	6·15	2·09	0·46	6·18	1·67	3·47

In this change, as represented by the following equation, part of the muscovite of the phyllite has been altered to andalusite, and the potassium silicate and silica so liberated have, with chlorite, formed biotite; $40SiO_2,20R_2O_3,2RO,4K_2O,2Na_2O,12H_2O$ (muscovite) + $6SiO_2,6R_2O_3,8RO,10H_2O$ (chlorite) = $12Al_2SiO_5$ (andalusite) + $18SiO_2,6R_2O_3,10RO,3K_2O,3H_2O$ (biotite) + $16SiO_2,8R_2O_3$, $3(Na,K)_2O,5H_2O$ (potash-soda mica) + $14H_2O$.

At Rothschönberg, in Saxony, a phyllite is altered into a rock composed of muscovite, biotite, and quartz; analyses show the presence of more free silica in the phyllite than in the altered rock, so that here biotite has been produced from chlorite and quartz, the potassium having been supplied by the muscovite. From chlorite or muscovite with quartz, cordierite may be produced. L. J. S.

Meteoric Iron. By EMIL W. COHEN (*Ann. k. k. naturhist. Hofmuseums Wien*, 1897, **12**, 42—62).—New analyses of the Nenntmannsdorf (Saxony), Lion River (S. Africa), Prambanan (Java), and

Chesterville (S. Carolina) irons gave the results under I, II, III and IV respectively; these differ from previous analyses in showing the presence of cobalt. It is pointed out that in octahedral irons, as in Lion River and Prambanan, the amount of Ni + Co is 8—11 per cent.

The Zacatecas (Mexico) iron gave analysis V; in the hydrochloric acid residue, there is an undetermined phosphide of nickel containing a relatively large amount of copper and but little iron. The mineralogical composition of this iron is given as

Nickel-iron.	Schreibersite.	Troilite.	Daubréelite.	Chromite and silicate.	Carbon.	Nickel phosphide ?	Undet. residue.
94·34	3·54	0·26	0·10	0·21	0·03	1·08	0·44

A new analysis of rhabdite from the See-Läsgen iron (compare Abstr., 1897, ii, 57) gave VI, from which (Fe,Ni,Co) : P = 3·109 : 1.

The Bischtübe (Russia) iron has the mineralogical composition,

Nickel-iron.	Nickel-iron phosphide.	Carbon.	Chromite and silicate.	Undet. residue.
96·97	2·52	0·09	0·01	0·41

The schreibersite, together with a little rhabdite from this iron, gave analysis VII, agreeing with $(Fe,Ni,Co)_3P$, and the flexible plates of tænite gave VIII. The present results differ considerably from Kislakowsky's (Abstr., 1892, 418), who found 17·90 per cent. of olivine and anorthite.

A new analysis of cohenite from the Wichita Co. (Texas) iron gave, after deducting about 8 per cent. of schreibersite, the results under IX, agreeing with the formula $(Co,Ni,Fe)_3C$; the variations shown in previous analyses are to be explained by the presence of tænite.

An iron carbide from the telluric iron of Ovifak (Greenland) gave analysis X, showing it to be probably identical with the meteoric cohenite.

	Fe.	Ni.	Co.	P.	C.	Cr.	S.	Insol.	Total.	Sp. gr.
I.	94·33	5·48	0·71	0·29	—	nil.	—	—	100·81	7·8241
II.	92·06	7·79	0·69	0·05	—	—	—	—	100·59	—
III.	90·03	9·39	0·97	0·16	—	—	—	—	100·55	—
IV.	93·15	5·82	0·73	0·34	—	—	—	—	100·04	7·8738
V.	92·09	5·98	0·91	1·02	—	0·74	0·18	0·04	100·96	—
VI.	46·32	38·06	0·94	14·89	—	nil.	—	0·94	101·15	—
VII.	66·19	18·47	0·43	15·58	—	—	—	0·07	100·74	—
VIII.	62·19	35·90	0·35	0·92	0·75	—	—	—	100·11	—
IX.	90·80	2·37	0·16	—	6·67	—	—	—	100·00	7·3236
X.	92·73	0·95	0·39	—	5·93	—	—	—	100·00	—

L. J. S.

Physiological Chemistry.

Metabolism during Muscular Work in Dogs. By NATHAN ZUNTZ (*Pflüger's Archiv.*, 1897, 68, 191—211).—All mammals hitherto investigated need, in normal work, nearly the same amount of chemical energy per work unit, somewhat more than a third of the available energy appearing as external work, whilst the remainder is changed into heat. In pulling work, the useful effect of the transformed energy is somewhat smaller than in climbing, and diminishes with increase of work. The horizontal movements of the animal's own body require, for equal weights moved through the same distance, so much the more work the smaller the animal is. The relationship between the work and the transformation of energy is nearly proportional to the superficial area of the body. W. D. H.

Solubility of Paracasein in Artificial Gastric Juice. By W. Lindemann (*Virchow's Archiv.*, 1897, **149**, 51—65).—Previous researches on caseinogen (here called casein) have shown that the residue obtained on gastric digestion is small, and with excess of gastric juice is absent (Salkowski).

In the present investigation, casein (here called paracasein) was employed, and the powdered proteid subjected to the action of gastric juice (in some experiments, however, it was previously dissolved in a minimal quantity of alkali); a residue was found in all cases, varying from 0·12 to 10·07 of the substance taken, but the percentage usually obtained was 3 or 4. Casein is, therefore, less digestible than caseinogen; the residue is smaller the larger the amount of digesting fluid employed; the quantity of acid in the mixture has some influence, but the duration of the digestion beyond 24 hours has none. W. D. H.

Origin of Fat from Proteid. By Eduard Pflüger (*Pflüger's Archiv.*, 1897, **68**, 176—190).—A further polemical contribution to a much discussed subject; the author does not believe in the origin of fat from proteid, and seeks to show from the experiments of those workers who do believe in it, that their conclusions are incorrect.

W. D. H.

Fat of Muscle: Estimation of Fat in Animal Substances. By Elly Bogdanow (*Pflüger's Archiv.*, 1897, **68**, 408—430; 431—433). —The principal point made out is that, in the later extractions of muscle with ether, the fat obtained is different from that obtained in the first extracts, and that the fat obtained last is very rich in free fatty acids; this confirms the observations of Dormeyer, who used an entirely different method. The method here used is explained at full length, with wood-cuts of the apparatus employed.

Extraction of animal tissues with ether does not, however, extract all the fat; more goes into solution on subsequent extraction with boiling 90 per cent. alcohol. The largest yield is obtained by a five days extraction with alcohol in a Soxhlet's apparatus, after the finely divided material has been allowed to remain a day under ether. The experiments in this direction are not complete, but it is hoped that this simple method will give results equally trustworthy with those obtained by Dormeyer's more complicated process. W. D. H.

Biological History of Phosphates. By Léopold Jolly (*Compt. rend.*, 1897, **125**, 538—539).—The ordinary molybdic acid solution in dilute nitric acid serves for the detection of phosphates in animal tissues, to which, if they contain phosphoric acid or its salts, a yellow colour is imparted. No similar coloration is produced by macerating the same tissues with nitric acid of the same strength. The author's observations show that many tissues, even after being macerated for some time with dilute acetic acid or dilute nitric acid, retain phosphoric acid which can be detected by means of the molybdic reagent in the manner indicated. It follows that the association of the tissues with this part of the phosphoric acid must be of a very intimate character. C. H. B.

Catechol-like Substance in the Suprarenal Capsules. By Otto von Fürth (*Zeit. physiol. Chem.*, 1897, **24**, 142—158).—This paper gives an account of attempts to isolate the substance which has been known since Vulpian's researches to exist in the medulla of the suprarenal capsules and gives a greenish colour with ferric chloride. The author does not appear to have been any more successful in these attempts than his predecessors; he describes the material as catechol-like, but admits that it contains nitrogen. W. D. H.

The Organic Ground Substance of Fish Scales. By Carl Thore (Graf) Mörner (*Zeit. physiol. Chem.*, 1897, **24**, 125—137).—The scales of various fishes were investigated, and the organic ground substance was found to be not wholly composed of collagen, about a fifth of it consisting of another albuminoid named *ichthylepidin*, which differs from collagen in containing loosely united sulphur, from keratin in its small percentage of sulphur (1·09), and from elastin by its smaller resistance to chemical reagents. W. D. H.

Composition of Sow's Milk, with Special Regard to the Amount of Fat. By M. Petersen and Fr. Oetken (*Bied. Centr.*, 1897, 711—712; from *Milchzeit.*, 1896, 665).—The examination of seventeen samples of sow's milk, from Oldenburg, and of a few other samples, showed that the amounts of fat and dry matter are greater than in cow's milk. The following percentage results are given. Fat, 2·4 to 12·1; dry matter (average of four samples), 20·4; proteids, 3·8 to 5·3; sp. gr. (one sample only) = 1·0128. The high percentage of fat (average of 22 samples = 6·6) is in accordance with previous results. N. H. J. M.

Physiological Action of Tannin and Gallic Acid. By Erich Harnack (*Zeit. physiol. Chem.*, 1897, **24**, 115—124).—By administering to men or dogs small, medicinal doses of tannin or gallic acid, the quantity of gallic acid in the urine is very small, but the greater amount is contained in the fæces. It is probable that some of the gallic acid which passes into the urine is decomposed, and traces of pyrogallol are found, if, in searching for it, the acidified urine has been evaporated; if the evaporation is omitted, pyrogallol is never found. Pyrogallol is highly poisonous, and is not formed in the organism.

On giving larger doses of gallic acid, more passes into the urine, especially if alkalis are given as well.

By feeding on free tannin, none passes into the urine; but it is found after giving a freshly-prepared solution of tannin in alkali. For the isolation of tannin, the salting-out method by saturated sodium chloride solution, and precipitation by solution of gelatin or albumin free from globulin, is recommended. The separation of small quantities of pyrogallol and gallic acid is only possible when the solubility of the former in boiling benzene is made use of. W. D. H.

[Physiological Action of Naphthalene.] By Theo. Klingman (*Virchow's Archiv.*, 1897, **149**, 12—22).—A number of previous workers have noticed that the most marked effect of the administration of naphthalene is an opacity of the lens and other degenerative changes in the eye-ball. In the present research on rabbits, naphthalene dissolved in liquid paraffin was given by the stomach; in the urine, phenol was found corresponding to about a tenth of the naphthalene given. The animals were killed at varying intervals; in the early stages, an irido-cyclitis was found, which is believed to be the starting point of the subsequent eye-changes in the cornea, lens, and retina. The primary lesion is not in the retina, as Panas considered. W. D. H.

Physiological Action of Eucaine B. (4-Benzoyloxy-trans-2 : 2 : 6-trimethylpiperidine). By Gaetano Vinci (*Virchow's Archiv.*, 1897, **149**, 217—235).—The action of eucaine B. (4-benzoyloxy-*trans*-2 : 2 : 6-trimethylpiperidine) is similar to that of eucaine, previously described (*ibid.*, **145**), and of cocaine. Locally, it dilates the blood-vessels, although in smaller measure than does eucaine, and it also enlarges the pupil. Anæsthesia is produced, as with cocaine and eucaine, by direct contact with the sensory nerve-endings. There is an action on the central nervous system, and a curare-like paralysis of the motor and vagus nerve-endings; this is attributed to the absence of the COOH group, and is not observed with eucaine and cocaine, which contain that group. Eucaine B has an antiseptic action; it is less soluble than the other drugs, but is cheaper and an equally good local anæsthetic. W. D. H.

Chemistry of Vegetable Physiology and Agriculture.

Nature of Fermentative Changes in Natural and Polluted Waters, and in Artificial Solutions, as Indicated by the Composition of the Dissolved Gases. Part IV. Humus: Its Formation and Influence in Nitrification. By Walter E. Adeney (*Trans. Roy. Dublin Soc.*, 1897, [ii], **6**, 269—281. Compare Abstr., 1896, ii, 322).—The author gives reasons for adopting the terms, carbon oxidation and nitrogen oxidation or nitrification, to respectively denote the two stages by which organic substances successively undergo complete aërobic bacterial fermentation in waters. With the adoption of these terms, the author proposes the classification of all fermentable substances into (1) carbon-oxidisable substances, or all fermentable organic substances which have not undergone carbon-oxidation; and (2) nitrifiable substances, or ammonium compounds, and organic compounds which have suffered carbon-oxidation.

The author has described the changes which result from these two stages of fermentation, in his previous communication. The object of the experiments now recorded has been to ascertain the fermentative properties of the humus of ordinary cultivated soils, and thereby to complete the information already published (*loc. cit.*) on the fermentative properties of the nitrifiable organic substances which are to be found in natural waters.

The humus employed in these experiments was obtained from a large heap of wet refuse matter, which consisted of the solid matters that had been separated from sewage and mixed with freshly precipitated manganese peroxide in about equal proportions. The heap was allowed to ferment for about three months, at the expiration of which time the peroxide was found to be completely reduced and converted into manganese carbonate. The organic matters, which at this time amounted to about 8 per cent. of the air-dried mass, were also found to have undergone a practically complete first-stage fermentation or carbon oxidation, and to have all the properties of the humus of ordinary cultivated soil.

That the reduction of the peroxide to carbonate of manganese can be brought about by bacterial fermentation, has been shown by McWeeney, who found that, when freshly precipitated manganese peroxide was kept in sterilised liquid media, it remained unchanged, but that when the same media were seeded with small pieces of the fermented refuse matters above referred to, a rapid and abundant growth of living organisms ensued, and the complete reduction of the peroxide to carbonate quickly followed.

The author records a number of experiments with this humus, which show that it possesses fermentative properties similar to those which he has already shown peaty colouring matters and fermented organic matters to possess, the most characteristic property of which is to determine the *nitric* fermentation of ammonium compounds.

The possible changes which nitrifiable substances, to be met with in natural waters, may undergo are summarised as follows.

1. When the nitrifiable organic substances are freshly formed, and are present in comparatively large quantity in a water, the formation of a volume of carbonic anhydride, in proportion to the volume of oxygen consumed, and the formation also of a quantity of nitrous or of nitric acid, or of both, but in small quantities, may attend the earliest stage of fermentative change they may undergo.

2. At subsequent stages, the volume of carbonic anhydride formed is not so large, and the quantity of inorganic nitrogen products, nitrous or nitric acid, becomes more marked, in proportion to the oxygen consumed.

3. At a still later stage, at the completion of which all the ammonia becomes fermented, little or no carbonic anhydride may be formed, but, on the contrary, a little may become "fixed"; the inorganic nitrogen product consists then of nitric acid solely.

4. When little or no ammonia is present, freshly formed nitrifiable organic matters may undergo at first a slow change, during the first steps of which distinct amounts of carbonic anhydride and of oxygen may be formed and consumed, respectively; small quantities of nitric acid are formed at the same time.

5. But, after these earlier steps of change, the fermentation becomes

slower, and finally so slow as to be scarcely appreciable; still, the results are the formation of carbonic anhydride and nitric acid, and the consumption of a proportionately small volume of oxygen. W. E. A.

Fermentation Phenomena. By ALFRED STAVENHAGEN (*Ber.*, 1897, **30**, 2422—2433).—A solution prepared from yeast by Buchner's method (Abstr., 1897, ii, 154), but filtered through a Chamberland filter, was found to be perfectly sterile and possessed all the properties of that prepared by Buchner, except that it did not cause the slightest fermentation with cane-sugar, glucose, or milk-sugar. The author considers that the acknowledged presence of micro-organisms in the solution obtained by Buchner is sufficient to invalidate his experiments on the fermentation of sugar without yeast cells. A. H.

Chemical Characteristics of the Woody Matter of the Oak. By PAUL METZGER (*Bied. Centr.*, 1897, **26**, 678—679; from *Inaug. Diss. Munich*, Heilbronn, 1896).—The sap-wood and heart-wood of oak both contain the same tannin, the composition of which agrees fairly well with Böttinger's formula, $C_{15}H_{16}O_{11}$. The tannin of the bark, however, seems to be present in a partly decomposed condition, and to contain phlobaphen. Both tannins must be considered as glucosides, as they are converted by boiling with dilute acids into phlobaphen, gallic acid, and glucose. Phlobaphen, $C_{33}H_{34}O_{13}$, is capable of taking up twelve acetyl groups.

Free gallic acid was found in the bark, sap-wood, and heart-wood of all ages. All three parts of the wood contain the same fats (the glycerol ethers of palmitic, stearic, cerotic, and oleic acids), oxalic, malic, and tartaric acids, cholesterol, cane-sugar, and pentosans. Starch occurs in the sap-wood and in the heart-wood, but not in the bark.

The amount of ash in the bark decreased from the root to the top, but increased in the sap-wood and heart-wood. The phosphoric acid in the bark increased towards the top, but diminished in the sap-wood and heart-wood; there was only an increase of phosphoric acid in the sap-wood of the newest shoots. Chlorine could not be detected in any of the ashes. N. H. J. M.

Effect of Humus on the Percentage of Nitrogen in Oats. By HARVEY W. WILEY (*Landw. Versuchs.-Stat.*, 1897, **49**, 193—202).—A number of experiments, extending over three years, are described, in which oats were grown in large pots containing peaty soil, without manures and with a variety of manures. The soil contained, on the average, less than 10 per cent. of mineral matter, over 2·5 per cent. of nitrogen, and very little potash and phosphoric acid. The best of the soils employed was free from nitrifying organisms, but contained ammonia organisms in a fairly active condition.

The most striking result obtained was the high percentage of nitrogen in the produce, amounting to about 25 per cent. more than is found in oats grown on ordinary arable land. This increase is mainly in amide nitrogen and not in proteid nitrogen, and is, at least in part, due to direct absorption, from the soil, of nitrogenous matter which has not been nitrified. The following average results show the total and amide nitrogen of the produce.

Grain and chaff.		Straw.		Roots.	
Total N.	N. as amides.	Total N.	N. as amides.	Total N.	N. as amides.
2·63	0·35	1·99	0·70	1·45	0·32

The amount of proteid nitrogen remained within the limits of the usual amounts obtained on ordinary soil.

Potash and nitrogenous manure, in the amounts applied, had no appreciable effect on the amount of produce. Phosphates raised the yield and, at the same time, lowered the percentage of nitrogen, probably owing to the increased crop rather than to any injurious action of the phosphates.

The three phosphatic manures employed (Florida phosphate, basic slag, and superphosphate) had almost the same effect on the amount of produce. N. H. J. M.

Analytical Chemistry.

Use of the Electrometer as Indicator in the Titration of Acids and Bases. By Wilhelm Böttger (*Zeit. physikal. Chem.*, 1897, **24**, 253—301).—Behrend (Abstr., 1893, ii, 387) has shown that an electrometer may be used to determine the end point in mercury titrations, a chain being employed of the type: mercury | mercurous nitrate | mercurous nitrate | mercury. The author shows that a similar method may be used in the titration of acids and bases, if a hydrogen electrode be employed, the form used by the author being made of gold electrolytically coated with palladium, the E. M. F. being determined by the aid of a capillary electrometer and a Clark or Weston normal cell. Titrations were made of solutions of hydrochloric, isobutyric, tartaric, phosphoric, arsenic, and carbonic acids, and of sodium hydroxide, aniline, ammonia, and a mixture of sodium hydroxide with benzylamine. The E. M. F. was found, after the addition of each c.c. of the neutralising liquid, and in a second experiment after each drop, in the neighbourhood of the point of neutralisation. Curves are constructed with the number of c.c. added as ordinates, and the E. M. F. as abscissæ. The form of the curve depends on the dissociation constant of the acid, but in all cases it ascends, at first slowly, then very rapidly, then again slowly, an almost vertical part indicating the neutral point. In all the cases considered, the form of the curve is the same as that obtained theoretically from the equation

$$\pi = 0{\cdot}0002T.\log C_2/C_1,$$

where C_2 and C_1 are the ion concentrations of the hydrogen, although the absolute values of the E. M. F. may not agree always with those obtained from the curve. For the weak acids, the method is also available, whilst with phosphoric and arsenic acids the points corresponding with the formation of the compounds NaH_2PO_4 and Na_2HPO_4 and the corresponding arsenic salts are indicated. With arsenious and boric acids, the point where one-third of the hydrogen is displaced is seen on the curve. The availability of the method for weak organic acids is also proved, and the author points out that the agreement of the results with the theoretical deductions may be also taken as a further proof of the validity of the theory. L. M. J.

Estimation of Perchlorate in Sodium Nitrate. By F. Winteler (*Chem. Zeit.*, 1897, **21**, 75—76).—Ten grams of the sample of "Chili saltpetre" is introduced into a tube containing 10 c.c. of fuming nitric acid and a little silver nitrate. The tube is then sealed and heated for 5 hours at 230°. The silver chloride thus formed is afterwards weighed.

Any chlorine existing as chloride or chlorate must be determined and allowed for. L. de K.

Separation of Bromine from Mixtures of Bromides and Chlorides. By Henri Baubigny and Paul Rivals (*Compt. rend.*, 1897, **125**, 527—530).—When bromine is liberated from dissolved bromides by the action of cupric sulphate and potassium permanganate, the collection and direct estimation of the bromine is difficult. Distillation with water vapour is inconvenient, owing to the large volume of condensed liquid, but the bromine can readily be carried over in a current of air and absorbed in a dilute solution of an alkali. The salt to be analysed and the copper sulphate are dissolved in a flask with a neck 160 mm. long, and the permanganate is then added. The condenser tube and the tube carrying the current of air pass through a stopper which is ground into the neck of the flask. The alkali solution (3 or 5 per cent.) is contained in an inclined absorption tube consisting of a series of bulbs connected by short, narrow tubes and the absorption is complete even when 2250 c.c. of air per minute is passed through the liquid in the flask from a tube 3 mm. in diameter. The liquid in the flask may be heated by means of a water bath to any desired temperature, and, in order to compensate for evaporation, the air may first be saturated with water vapour by bubbling it through water contained in a flask heated in the same water bath.

When all the bromine has been expelled and absorbed, the liquid in the absorption tube is mixed with some sulphurous acid, then with silver nitrate solution, and finally with nitric acid in moderately large excess; the liquid is boiled for some time, and the precipitated silver salt dealt with in the usual way. C. H. B.

Estimation of Sulphur in Iron. By Otto Herting (*Chem. Zeit.*, 1897, **21**, 87).—The author states that the results obtained by Wiborgh's colorimetric process are untrustworthy, as the quantity directed to be taken for analysis is far too small. The best results are obtained by Wood's cadmium process, the sulphur in the cadmium precipitate being titrated by means of iodine.

De Koninck's proposal of adding a little stannous chloride when dissolving the sample in hydrochloric acid, so as to prevent oxidation of the hydrogen sulphide, is considered by the author to be superfluous, although it must be admitted that the action proceeds in a more steady and regular way (Abstr., 1895, ii, 528). L. de K.

Estimation of Sulphur in Pyrites by means of Sodium Dioxide. By Charles Glaser (*Chem. Zeit.*, 1897, **21**, 40—41).—When pyrites is oxidised by heating it with sodium dioxide, the melt, on being treated with water, sometimes deposits a blackish powder which contains ferrous sulphide. The author now states that, in such a case, the experiment need not be rejected; it is only necessary to add a little more of the sodium dioxide to ensure complete oxidation.

When testing pyrites rich in sulphur, there is no necessity for rendering the silica insoluble before precipitating with barium chloride, but excess of the latter should be avoided. L. DE K.

Estimation of Mixed Sulphides, Sulphites, Sulphates, and Thiosulphates. By FRED W. RICHARDSON and HENRY E. AYKROYD (*J. Soc. Chem. Ind.*, **15**, 171—173).—One portion of the solution is devoted to the estimation of sulphates, the neutral solution having been acidified with 5 grams of tartaric acid, is precipitated in the cold by barium chloride; the thiosulphates remain undecomposed, and the precipitate contains only some barium sulphate with some sulphite, the latter being removed by treatment with hot dilute hydrochloric acid and washing with hot water. From another portion of the solution, the sulphides are precipitated by ammoniacal zinc chloride. The filtrate from the zinc sulphide is then coloured with methyl-orange, and N/10 sulphuric acid run in until the change in the indicator shows that the sodium sulphite has been converted into sodium hydrogen sulphite. The mixture is now made up to a known volume and employed for titrating a measured quantity of N/10 iodine solution, after which the acidity developed is ascertained by titration with N/10 sodium hydroxide. In accordance with the equation $NaHSO_3 + H_2O + I_2 = NaHSO_4 + 2HI$, each molecule of sodium sulphite originally present will require three molecules of sodium hydroxide to restore neutrality. The excess of iodine above that consumed by the sulphite is calculated into thiosulphate. The results obtained in analysing a solution of known composition were very close. M. J. S.

Estimation of Phosphorus in Iron and Steel. By OTTO HERTING (*Chem. Zeit.*, 1897, **21**, 138—139).—The author did not get satisfactory results with Carnot's method of direct weighing of the molybdate precipitate; moreover, no better results were obtained with Mauermann's process, in which the precipitate is dissolved in standard ammonia and the excess titrated with standard acid, using corallin as indicator. A colorimetric method proposed by Namias, based on the blue coloration developed when dissolving the yellow precipitate in sodium thiosulphate, gives good results, but offers no special advantage over Emmerton's permanganate process.

The latter process has been slightly modified by the author. One gram of pig-iron is dissolved in 50 c.c. of nitric acid of 1·135 sp. gr., heated to boiling, and mixed with 20 c.c. of a solution of potassium permanganate (8 grams per litre); after boiling for 2 minutes, a saturated solution of ammonium oxalate is added drop by drop until the brown manganese precipitate has redissolved. After boiling for another 2 minutes, 5 c.c. of nitric acid of sp. gr. 1·42 is added, the liquid filtered, and the insoluble matter washed twice with hot water; as soon as the temperature has fallen to 65°, the liquid is poured into a beaker containing 100 c.c. of molybdate solution, heated at 60°, and well stirred. The precipitation of the phosphoric acid is complete in 15 minutes; the bulk of the liquid is now poured off, and the precipitate washed on a filter with acid ammonium sulphate solution (10 grams ammonium sulphate, and 20 c.c. of sulphuric acid in 1 litre of water) until all the iron is removed. The precipitate is then dissolved off the filter by means of dilute ammonia, and filtered into an Erlenmeyer flask containing 10 grams of granulated zinc; dilute sulphuric acid (1 : 2) is added in excess, and the whole heated for 8 minutes. It is then filtered through a quick filter containing a few pieces of zinc, and the filtrate at once titrated with permanganate; the strength of the permanganate expressed in iron, multiplied by 0·0164, represents the phosphorus. When testing wrought iron or steel, 5 grams of the sample is dissolved in 90 c.c. of nitric acid of 1·135 sp. gr., and 10 c.c. acid of 1·42 sp. gr. is afterwards added. L. DE K.

Estimation of Citrate-Soluble Phosphoric Acid in Basic-Slags. By O. BÖTTCHER (*Chem. Zeit.*, 1897, **21**, 168—169).—The author states that, if the solution of the basic-slag in Werner's ammonium citrate solution is mixed with a sufficiency of magnesium mixture and well agitated in a shaking apparatus for half an hour, the precipitation of the phosphoric acid is complete. If, however, the liquid is not then at once filtered, a gradual separation of silica will take place and the results will be untrustworthy. L. DE K.

Detection of Carbamic Acid. By PIERRE NOLF (*Zeit. physiol. Chem.*, 1897, **23**, 505—520).—The author shows that "(1.) Normal ammonium carbonate, or a mixture of ammonium chloride and sodium carbonate, yields a considerable quantity of carbamic acid when treated by Drechsel's method. (2.) The same is true of ammonium hydrogen carbonate, or a mixture of pure sodium hydrogen carbonate and ammonium chloride. (3.) An aqueous solution of free carbonic acid and ammonium chloride gives a similar result. (4.) Instead of ammonium chloride, other ammonium salts can be used; for example, the nitrate, oxalate, or acetate." Both dilute (1 : 600) and comparatively concentrated solutions were experimented with. The presence of carbamic acid was detected by shaking, preferably at 0°, first with a little lime, and again after adding calcium chloride; the liquid was now either filtered and sealed up in a glass tube, when the gradual appearance of a turbidity indicated the presence of calcium carbamate, or it was filtered into alcohol, the residue digested with ammonia, and the extract also filtered into alcohol, the precipitate that formed in the alcoholic liquid being examined after the lapse of half an hour, to see whether it had the characteristic form of calcium carbamate. It is concluded "that not only the reactions of carbamic acid, but calcium carbamate itself, will be obtained by Drechsel's method, wherever ammonium carbonate is present in solution, or free carbonic acid side by side with an ammonium salt." A quantitative estimation is only possible when it is a solution of the calcium salt that is being dealt with; the amount of ammonium carbamate present in an alkaline solution is purely a matter of chemical equilibrium. C. F. B.

Estimation of Free Alkali and Alkali Carbonate in Soaps, with and without the use of Alcohol. By William Waltke (*Chem. Zeit.*, 1897, **21**, 137).—The author states that soap should not be dried before extracting with alcohol, as the caustic alkali is then to a serious extent converted into carbonate by the carbonic anhydride from the air. Better results are obtained by dissolving 5 grams of the sample in 75 c.c. of absolute alcohol contained in an Erlenmeyer flask fitted with a soda-lime tube to prevent carbonic anhydride from entering the flask; after dissolution has been completed by the aid of a gentle heat, the liquid is filtered inside a water oven, the insoluble matter washed a few times with hot absolute alcohol, and the free alkali then titrated with N/10 sulphuric acid, using phenolphthalein as indicator. To estimate any alkali carbonate, the insoluble residue is dissolved in cold water, and also titrated with the acid, this time using methyl-orange as indicator.

The estimations may also be made without using alcohol. The free alkali can be estimated by dissolving 5 grams of the sample in 250 c.c. of hot water freefrom carbonic anhydride, and pouring this solution slowly into 100 c.c. of a 5 per cent. solution of barium chloride. The free alkali in the filtrate is then titrated as before. Another 5 grams of soap is then dissolved in 15 c.c. of water and nearly dried on a sand bath with constant stirring, passing a current of carbonic anhydride over the mass all the time. After drying at 110°, the residue is weighed to ascertain the amount of moisture; the carbonic anhydride is then estimated by means of a Geissler's apparatus, and after allowing for the amount absorbed by the free alkali, the difference is calculated into alkali carbonate. L. de K.

Estimation of Silver in Silver Plating Solutions. By T. J. Baker (*Chem. News*, 1897, **76**, 167).—Weighing the precipitate obtained with hydrochloric acid, also fusing the impure silver chloride with sodium carbonate and nitre, give unsatisfactory results; therefore, the author boils about 50 c.c. of the solution with a slight excess of nitric acid, filters, washes, and dries the precipitate, wraps it and the filter ash together in assay lead, and then cupels. D. A. L.

Separate Estimation of Alumina and Iron Oxide in Phosphates. By F. Lichtschlag (*Chem. Zeit.*, 1897, **21**, 264—265).—Two grams of the sample is fused with 8 grams of sodium carbonate for 20 minutes, then quickly cooled, and the product, which can readily be detached from the platinum crucible, is put into a beaker, the crucibe being rinsed with dilute hydrochloric acid, which is then used to dissolve the melt. When the latter is completely dissolved, the solution is neutralised in a 200 c.c. flask with aqueous soda, heated to boiling, 30 c.c. of a 20 per cent. solution of aqueous soda is added, and the whole heated for 15 minutes. When cold, the liquid is made up to the mark, and 75 c.c. is poured off through a quick filter; as soon as 50 c.c. has collected, it is mixed with excess of hydrochloric acid, a few drops of sodium phosphate solution are added, and, after boiling, the alumina is precipitated as phosphate by adding a very slight excess of ammonia.

The residue on the filter is dissolved in hydrochloric acid, which is then added to the contents of the flask; after adding some more acid, the liquid is introduced into a 500 c.c. flask and the iron reduced at 70° by means of zinc. When cold, the liquid is made up to the mark, and the titration proceeded with as Fresenius directs. L. DE K.

Estimation of Manganese in Steel and Iron. By LEOPOLD SCHNEIDER (*Chem. Zeit.*, 1897, **21**, 41).—The sample is dissolved in nitric acid, and the solution, diluted with twice its volume of water, is boiled and mixed with pure lead peroxide, when the manganese is instantly oxidised to permanganic acid. After filtering through asbestos, the filtrate is titrated with a standard solution of hydrogen peroxide until colourless. The hydrogen peroxide solution is standardised against a known weight of potassium permanganate dissolved in dilute nitric acid. L. DE K.

Estimation of Chromium in Chrome Ore and Ferrochromium. By ERNEST H. SANITER (*J. Soc. Chem. Ind.*, **15**, 155—158). —This paper is partly controversial. The author has modified Clark's process (Trans., 1893, 1079) and claims, in opposition to Rideal and Rosenblum (*J. Soc. Chem. Ind.*, **14**, 1017), that chrome ore ground only "moderately finely" in an agate mortar can be completely decomposed in 3 minutes. A nickel capsule 2 inches wide and 1 inch deep is used. 0·5 gram of the chrome ore and 3 grams of sodium dioxide are mixed in the capsule, which is then held by tongs in a Bunsen flame. As soon as the mass begins to melt, a circular motion is given to the capsule to prevent the ore from settling. The temperature should be just below a visible red. When cold, the capsule is placed in a large basin and filled with cold water, and after the melt has dissolved it is rinsed with hot water. The solution, diluted to about 300 c.c. with hot water, is then coloured pink by adding potassium permanganate; 100 c.c. of dilute hydrochloric acid (1 : 1) is now gradually added, and the solution boiled until clear; 150 c.c. more hot water is added and the boiling continued for 10 minutes, by which time all chlorine is expelled. The cooled solution, now measuring 500 c.c., is titrated with ferrous sulphate and dichromate. At this dilution, the nickel present, derived from the nickel capsule used, does not interfere with the titration.

Ferrochromium is crushed until the whole sample passes through a sieve of 10,000 meshes to the square inch. For 0·3—0·5 gram of substance, 4 grams of sodium dioxide and 0·75 gram of barium peroxide are taken, and the process is the same as before, except that a larger quantity of potassium permanganate is added, to prevent reduction of chromate by the barium peroxide.

[SAMUEL RIDEAL and SIGMUND G. ROSENBLUM], criticising the paper, state that they were unable to get complete decomposition in one fusion unless the chrome ore was very finely ground; that some sodium dioxide always remained at the end of the fusion and reduced some chromate on acidifying unless previously decomposed by boiling, for which 10 minutes sufficed; that the addition of barium peroxide is both useless and a source of complications, and that it is better to filter from nickel oxide than to trust to dilution for masking the brown colour it gives with ferricyanide. M. J. S.

Estimation of Chromium in Ferrochrome and Chromium Steel. By Jos. Spüller and A. Brenner (*Chem. Zeit.*, 1897, ii, 3—4). —*Assay of Ferrochrome.*—0·35 gram of the finely powdered sample mixed in a hemispherical silver dish with 2 grams of dry powdered sodium hydroxide and covered with 4 grams of sodium dioxide, is heated until the mixture begins to melt, when, as a consequence of the strong chemical action, the whole mass soon becomes liquefied. The dish is then again heated for 10 minutes over a powerful burner, and 5 grams of sodium dioxide is cautiously added, stirring all the while with a silver spatule. After heating for 30 minutes more, another 5 grams of sodium dioxide is added and the heating continued for 20 minutes, when a final 5 grams of the dioxide is added.

When cold, the silver basin is placed in a deep porcelain dish and filled with water; when the lixiviation is completed, which takes a few minutes only, the silver dish is lifted out and well rinsed with hot water. A brisk current of carbonic anhydride is then passed through the liquid for half an hour, the whole allowed to cool, introduced into a litre measure, and made up to the mark with water. After shaking and filtering, 250 c.c. is taken and the chromic acid titrated by Schwarz's method. If the solution of the melt appears green, it is advisable to add first a few c.c. of potassium permanganate solution, and then some more sodium dioxide, when a pure yellow liquid will be obtained.

Assay of Chrome-steel.—Two grams of the sample is dissolved in 20 c.c. of warm hydrochloric acid contained in a porcelain dish, 10 c.c. of dilute sulphuric acid (1 : 1) is added, and the whole evaporated to dryness; the residue is then transferred to a hemispherical silver dish and heated with 2 grams of sodium hydroxide and 5 grams of sodium dioxide, until the sulphates are decomposed and the mass begins to cake. A strong heat is now applied and another 5 grams of the dioxide is added. When the mass begins to fuse, it is well stirred with a silver spatula, and after 20 minutes another 5 grams of sodium dioxide is added; after another 20 minutes, when the oxidation is complete, a further addition of 5 grams of the soda is made and the mass is allowed to cool. The melt is then extracted as in the former case, but the liquid is made up to 500 c.c. only, and 250 c.c. of the filtrate (1 gram of sample) is taken for the titration of the chromium. In this case, the authors prefer titrating according to Zulkowsky's method; the liquid is put into a long, narrow beaker, mixed with 10 c.c. of a 10 per cent. solution of potassium iodide, and acidified with pure hydrochloric acid. To another beaker containing 20 c.c. of a solution of potassium dichromate (0·9833 gram per litre), 250 c.c. of water is added, then 10 c.c. of a 10 per cent. solution of potassium iodide and a little hydrochloric acid. After being left for 15 minutes in a dark place, both liquids are titrated with solution of sodium thiosulphate containing 4·96 grams of the salt per litre. The amount of chromium being known in the one solution, the quantity contained in the other is readily calculated. L. de K.

Estimation of Nickel in Nickel-steel. By Jos. Spüller (*Chem. Zeit.*, 1897, 21, 243—244).—If the samples contain at least 1 per cent. of nickel, the amount may be tolerably accurately estimated by dissolving 2 grams in 60 c.c. of nitric acid of sp. gr. 1·2, boiling until the nitrous fumes are expelled, and precipitating the iron by adding an emulsion of zinc oxide; the green filtrate is then collected in a suitable colorimeter, which may be improvised by using a beaker of about 7 cm. diameter placed on white glazed paper.

In a similar beaker is placed the filtrate obtained by dissolving 2 grams of a standard sample of nickel steel, removing the iron as before; on comparing the tints, the amount of nickel in the commercial sample can readily be estimated. L. DE K.

Separations with Alkali Acetates. II. Nickel from Iron. III. Cobalt and Manganese from Iron. By HARRY BREARLEY (*Chem. News*, 1897, 76, 49—51, 165—167. Compare Abstr., 1896, ii, 676).—*Nickel from Iron.*—The substance is dissolved in hydrochloric acid and oxidised with nitric acid, or, if only a small quantity, or no carbon is present, it is dissolved in nitric acid directly, diluted, cooled, an alkali carbonate added until a slight permanent precipitate is formed, and then 10 c.c. of acetic acid. The liquid is diluted to about a litre with hot or cold water, 10 to 12 c.c. of ammonium (sodium) acetate solution added for each gram of iron in solution, adding more if no turbidity appears on heating to near the boiling point. If turbidity appears too soon, the heating is stopped when the precipitate becomes flocculent and the solution nearly colourless, and if the precipitation is slow after the turbidity has appeared at the boiling point, the heating is prolonged. An aliquot part of the liquid is filtered through asbestos, cooled, neutralised, a measured quantity of dilute ammonia added, and the liquid then titrated with potassium cyanide and silver iodide. For a rapid result, or when there is sufficient ferric hydroxide to interfere, excess of cyanide is run in, the liquid filtered through asbestos, and titrated back with silver nitrate. By using ammonia salts, as much as 0·8 gram of nickel to 1 gram of iron may be estimated; the usual small amounts of manganese or chromium do not matter, but copper and larger amounts of manganese, chromium and aluminium must be removed. Large quantities of ammonia cause error, but the acetate, chloride, and nitrate do not do so appreciably. The last two, however, lessen the amount of alkali required to neutralise the iron solution and lower the temperature at which turbidity appears and also deepen it; whereas the sulphate, chloride, and nitrate lessen the turbidity in the order given. Artificial alizarin can be used as an indicator when neutralising the free acid; it gives a purple coloration in the presence of silver iodide, which changes to pink when the latter is dissolved.

Cobalt and iron can be separated as in the preceding case of nickel; its presence in the solution causes a variable and transitory darkening on the addition of cyanide, and, moreover, the silver iodide dissolves before all the cobalt is saturated. Therefore, the titration has to be modified, and the cyanide, which is standardised with cobalt in this case, is run in in excess and after a while titrated back with silver nitrate.

In manganese separations, and, in fact, in all these separations, the acetates should be used as sparingly as possible. D. A. L.

Analysis of Alloys of Tin, Antimony, and Copper. By Gustave W. Thompson (*J. Soc. Chem. Ind.*, 15, 179—182).—Commercial alloys of the above metals frequently contain, in addition, phosphorus, arsenic, bismuth, cadmium, nickel, and cobalt. The course of the analysis will naturally be modified by the absence of one or more of the metals, but the following method applies to cases where all are present. The alloy (1 gram) is dissolved in 100 c.c. of a solution made up as follows :—20 grams of potassium chloride in 500 c.c. of water, 400 c.c. of concentrated hydrochloric acid, 100 c.c. of nitric acid of 1·4 sp. gr. After concentrating to 50 c.c., the solution is cooled, precipitation of the lead chloride is completed by adding 2 vols. of 95 per cent. alcohol, and the precipitate, after being washed with a mixture of alcohol and hydrochloric acid (4 : 1), is dissolved in ammonium acetate, precipitated as chromate, and weighed. The filtrate from the lead chloride is evaporated to dryness, heated for 20 minutes with 10 c.c. of potassium hydroxide (1 : 5) and 20 c.c. of 3 per cent. hydrogen peroxide (the object of which is to prevent separation of sulphur with the antimony sulphide), then mixed with 10 grams of ammonium oxalate, 10 grams of oxalic acid, and 200 c.c. of water, and treated with hydrogen sulphide for 45 minutes at a nearly boiling temperature; this precipitates copper and antimony (also bismuth, cadmium, and partially nickel and cobalt), but leaves the tin in solution. After expelling hydrogen sulphide from the filtrate, the tin (with traces of nickel and cobalt, and also of iron, if present) is precipitated by electrolysing the solution for 12 hours with a current of 0·5 ampère. The copper and antimony sulphides are separated by heating with potassium hydroxide, the copper is converted into nitrate and titrated with potassium cyanide in ammoniacal solution (or precipitated electrolytically if in large amount), whilst the antimony, after being converted into antimonic chloride by boiling with hydrochloric acid and potassium chlorate, the excess of chlorine being expelled and the sulphur filtered off, is reduced to trichloride by adding potassium iodide, and estimated from a titration of the iodine liberated. Arsenic accompanies the antimony, and is best estimated in a separate portion by distilling the hydrochloric acid solution with sodium thiosulphate. Bismuth, cadmium, nickel, and cobalt sulphides would remain with the copper sulphide after separation of the antimony. Phosphorus is best estimated by Dudley's method. For the minuter details of the operations, and for simple methods suited only to special alloys, the original should be consulted. M. J. S.

Estimation of Organic Matter by Chromic Acid. By Joseph Barnes (*J. Soc. Chem. Ind.*, 15, 82—84).—With the view of superseding the old permanganate method of ascertaining the amount of oxygen absorbable by the organic matter in a water by a process in which the oxidation should be more energetic, the author has employed a hot mixture of chromic and sulphuric acids. The solutions used are: one containing 6·2 grams of potassium dichromate and 50 c.c. of concentrated sulphuric acid per litre, a solution of ferrous sulphate containing about 36 grams of the crystallised salt with 200 c.c. of sulphuric acid per litre, and a permanganate solution. To make an estimation, 50 c.c. of the water is mixed with 25 c.c. of concentrated sulphuric acid and 10 c.c. of the chromate solution, and is heated on the water bath for 1 hour. It is then rapidly cooled, 10 c.c. of the ferrous solution and 500 c.c. of cold water are added, and the excess of ferrous iron is titrated with the permanganate.

Another method is described in which permanganic acid is used: 100 c.c. of the water is mixed in a stoppered bottle with 10 c.c. of dilute sulphuric acid (1 : 2) and 10 c.c. of permanganate solution (4 grams per litre); and the bottle is kept at 21° for two and a half hours. An excess (10 c.c.) of ferrous sulphate is then added, and the excess titrated by a weaker permanganate solution (1 c.c. = 0·0005 gram of oxygen).

Blank experiments are required in both methods. A table is given showing the amount of oxygen absorbed by various organic matters in each process. The results are purely empirical, and are influenced (but in opposite directions) by variations in the amount of organic matter taken. M. J. S.

Fehling's Solution. By Milorad R. Jovitschitsch (*Ber.*, 1897, **30**, 2431—2432).—Mineral acids, such as sulphuric, nitric, and hydrochloric acids, reduce Fehling's solution, especially if the reaction be carried out in only slightly alkaline solution, the reduction being probably due to the decomposition of the tartaric acid by the mineral acid present; it is this, probably, which renders it necessary to carry out the tests with Fehling's solution in a strongly alkaline solution.

J. F. T.

Gravimetric Estimation of Sugars by Fehling-Allihn's Process. By Gottwalt Ambühl (*Chem. Zeit.*, 1897, **21**, 137—138).—The author has analysed 38 samples of wine, 4 of honey, and 4 of urine by the above process, and has tabulated the results.

The table shows that there is no necessity to reduce the cuprous oxide to metallic copper, as a direct weighing of the former gives sufficiently accurate results. L. de K.

Estimation of Furfuraldehyde by Means of Phloroglucinol. By Constantin Councler (*Chem. Zeit.*, 1897, **21**, 2—3).—The author (Abstr., 1895, ii, 144) states that it is of great importance to use phloroglucinol free from diresorcinol. Unless the amount of furfuraldehyde is very small, it is advisable to take an aliquot part only of the distillate for precipitation.

The amount of furfuraldehyde yielded on distilling a sample of brown coal with hydrochloric acid was no less than 0·22 per cent., corresponding with 0·408 per cent. of pentosan calculated on the dried sample. L. de K.

Colour Reactions of Pyruvic Acid. By Louis Simon (*Compt. rend.*, 1897, **125**, 534—536).—See this vol., i, 64.

Estimation of Fat in Animal Substances. By Elly Bogdanow (*Pflüger's Archiv.*, 1897, **68**, 431—433).—See this vol., ii, 84.

The Iodine Number of Fats and Oils. By Hugo Schweitzer and Emil E. Lungwitz (*J. Soc. Chem. Ind.*, **14**, 1030—1035).—The authors have already proved (Abstr., 1896, ii, 398) that in Hübl's process, substitution, as well as addition, of iodine occurs. They now show that the use of methylic alcohol, recommended by Fahrion, whilst it does not affect the total amount of iodine absorbed, increases the proportion employed in substitution. When the mercuric chloride is omitted, the iodine absorption consists chiefly, or, in the case of methylic alcohol, entirely, of substitution, but the proportion of substitutive iodine is not diminished by using more mercuric chloride than in Hübl's standard reagent. In chloroform and ethylic ether solutions, substitution also occurs to a large extent; but in carbon bisulphide and carbon tetrachloride solutions the absorption is additive only. Mercuric bromide, whether in ethylic or methylic alcohol, gives more substitution than mercuric chloride. Various other metallic chlorides were tried, employing ethylic alcohol solutions. With manganous chloride (or bromide), cobalt chloride, and nickel chloride, very little substitution occurred, but the total absorption was low and variable.

By working with carbon bisulphide solutions, in the presence of mercuric chloride, and at an elevated temperature (50—79°) in stoppered bottles and therefore under pressure, the iodine absorption may be made to exceed that produced by Hübl's normal process, being at the same time a purely additive one. In the case of oleic acid, the absorption exceeds that theoretically required, and this raises doubts as to the constitution of oleic acid. M. J. S.

Recognition of Margarine by means of Dimethylamidoazobenzene. By ALFRED PARTHEIL (*Chem. Zeit.*, 1897, **21**, 255—256).—In order to detect the presence of small quantities of margarine in butter, it has been proposed by Soxhlet to order all margarines to be mixed with a small quantity (1 : 100,000) of phenolphthalein. Any one would then be able to recognise adulterated butter by the reddish colour when the sample is mixed with a little soda. The use of phenolphthalein is, however, objectionable for many reasons, and the author now proposes to use dimethylamidoazobenzene dissolved in oil instead. This turns red on adding dilute sulphuric acid. L. DE K.

Analysis of Fats: Estimation of Unsaponifiable Matter. By JULIUS LEWKOWITSCH (*J. Soc. Chem. Ind.*, **15**, 13—14).—The processes in use may be classed under two heads: extraction of the soap solution with ether or light petroleum, and extraction of the dry soap by solvents. With certain oils, such as shark-liver oil, and some kinds of whale oil, both methods are unsuitable when petroleum is used, since the unsaponifiable matter is sparingly soluble in the cold petroleum, and at the same time much soap dissolves. The latter may be removed by washing the petroleum solution with 50 per cent. alcohol, but it is safer to use ethylic ether as the solvent, and correct for any dissolved soap by incinerating the residue left on evaporation and estimating the alkalinity of the ash. M. J. S.

Analysis of Fats: Wool Wax. By JULIUS LEWKOWITSCH (*J. Soc. Chem. Ind.*, **15**, 14—15).—Wool fat (Yorkshire grease) contains a considerable proportion of free fatty acids and true waxes, with a small quantity of free alcohols. The neutral portion, for which the author proposes the name "wool wax," is now obtainable in commerce. A specimen yielded 51·8 per cent. of unsaponifiable matter soluble in ether, also easily soluble soaps, and sparingly soluble soaps. The unsaponifiable matter had a melting point of 46—48°, iodine number 26·35. From its gain in weight when boiled with acetic anhydride (8·26 per cent.), cetylic alcohol must be almost absent, and the iodine number shows that there cannot be much cholesterol present. When heated at 250° with soda-lime, 80 per cent. of the alcohols was recovered unchanged, only 6 per cent. of fatty acids, of melting point 51—53°, being recoverable from the soap formed. The easily soluble soaps from the original substance yielded 25·5 per cent. of fatty acids, in which the presence of lactones was demonstrated. The sparingly soluble soaps also yielded fatty acids and lactones amounting to 26 per cent. The iodine values, &c., of these fractions are given, but no conclusions are drawn from the admittedly incomplete experiments. M. J. S.

Estimation of Resin in Fats and Soaps.—By John Landin (*Chem. Zeit.*, 1897, **21**, 25). The author has not succeeded in getting accurate results by using Gladding's silver process or Cornette's brine method.

The following modification of the Twitchell-Wilson process is recommended :—Three grams of the isolated fatty acids is dissolved in 30 c.c. of absolute alcohol contained in a flask surrounded by cold water, and dry hydrogen chloride is then passed through the solution for 45 minutes ; this converts the fatty acids into the corresponding ethylic salts, whilst the resinous acids remain unaltered. The mixture, in a separating funnel, is now treated with 125 c.c. of hot water, and shaken with 75 c.c. of light petroleum to dissolve the resin. The aqueous layer is then drawn off, and the petroleum solution shaken with a mixture of 0·5 gram of potassium hydroxide, 5 c.c. of alcohol, and 50 c.c. of water, to remove the resin ; from the alkaline solution, the resin acids are liberated by acidifying with hydrochloric acid, collected on a tared filter, dried, and weighed. L. de K.

Estimation of Caffeine in Tea. By Eustace H. Gane (*J. Soc. Chem. Ind.*, **15**, 95—96). The process suggested by Allen was found to give either identical or higher yields, a purer product, and greater facility of execution than the method of Paul and Cownley, which is usually employed (Abstr., 1888, 539). The following slight modification is preferred. Six grams of the finely powdered tea is boiled with 600 c.c. of water for 6 or 8 hours in a reflux apparatus ; 4 grams of lead acetate is then added, the boiling continued for 10 minutes longer, and the decoction filtered. 500 c.c. of the filtrate is evaporated to 50 c.c., and the excess of lead is removed by sodium phosphate. Finally, the liquid is concentrated to about 40 c.c., and the caffeine extracted by shaking five times with chloroform. M. J. S.

Opium Assay. By David B. Dott (*J. Soc. Chem. Ind.*, **15**, 91—94).—The British Pharmacopœia process for the estimation of morphine is vitiated by several erroneous features, especially the subdivision of the solution, the great dilution, the large amount of alcohol, and the drying at 100°. Squibb's process, official in the United

States, is more satisfactory, but is not free from objections. The author proposes two processes. (A.) Exhaust 10 grams of opium with alcohol of 0·92 sp. gr., evaporate to one-fourth, dilute this with half its volume of water containing 0·05 gram of ammonium oxalate, the object of which is to decompose the calcium meconate. Add ammonia until the liquid remains just perceptibly acid. After an hour, filter, concentrate to 8 c.c., transfer to a 100 c.c. flask by means of 2 c.c. of water, and 3 c.c. of alcohol, add 2·5 c.c. of ammonia (0·96 sq. gr.), and 25 c.c. of ether. Cork the flask, and shake occasionally during an hour. After 18 hours, decant the ether, collect the precipitate on a tared filter, wash with morphinated water, dry, wash with chloroform, and dry at 60°, at which temperature the precipitate has the formula $8C_{17}H_{19}NO_3 + 9H_2O$. It is very free from impurities.

For method B, which is more expeditious, but gives a less pure precipitate, see Abstr., 1896, ii, 283. M. J. S.

Estimation of Alkaloids. By E. H. Farr and Robert Wright (*Pharm. J. Trans.*, 1897, **58**, 202—203).—The estimation of morphine in opium by the official process of the British Pharmacopœia gives good results when carried out as follows. The very finely powdered opium (14 grams) is rubbed into a uniform paste with freshly slaked lime (6 grams) and water (40 c.c.), then 100 c.c. more water is added and the mixture stirred occasionally for half an hour; 104 c.c. of the filtered mixture, which is supposed to represent 10 grams of opium, is shaken for half an hour with ammonium chloride (4 grams), ether (50 c.c.), and rectified spirit (11 c.c.), and then allowed to remain for 12 hours. It is essential that the proportion of alcohol should not be too high, as otherwise more morphine is retained in the mother liquor. The ethereal layer is then removed and the mixture again extracted with 20 c.c. of ether, to ensure the removal of all substances soluble in that liquid; finally, the crystals of morphine are collected on tared filters, washed with a little distilled water, dried first by pressing between filter paper, then at a gentle heat, and finally at 96—100°, until a constant weight is obtained. The opium must be in a very fine powder, as otherwise a loss of morphine occurs amounting sometimes to 5 per cent. It is also advantageous to finish the drying of the morphine at 110°; some samples which were examined by the authors after drying at 100°, lost from 1·6 to 6·61 per cent., when heated at 110°. The loss of morphine in the mother liquors amounts to 0·1 gram for every 100 c.c. of the filtrate.

For the estimation of morphine in tincture of opium, the details are as follows: 80 c.c. of the tincture is evaporated to 20 c.c. at a low temperature, treated with freshly slaked lime (3 grams), and made up to 85 c.c.; 50 c.c. is then filtered into a 4 oz. bottle fitted with an accurately-ground stopper, and mixed with ammonium chloride (2 grams), ether (30 c.c.), and alcohol (5 c.c.). After the mixture has been shaken for half an hour and allowed to remain 12 hours, the layer of ether is removed by means of a pipette and the mixture shaken with 15 c.c. more ether, this being removed by means of a pipette, and filtered through tared filter papers. The filter is washed with a little ether, the residual ether allowed to evaporate, and then the crystals of morphine are washed on to the filter, and washed with morphinated water until the washings are colourless. The crystals, after drying at a gentle heat, are heated at 110° for one hour and weighed. 0·3 gram of the crystals is dissolved in a slight excess of N/10 sulphuric acid, and the excess of acid estimated by N/10 soda solution, using litmus paper as indicator. To the amount of anhydrous morphine in the total weight of the crystals as indicated by the titration, 0·05 gram is to be added. The combined weight multiplied by 2 will be the percentage of morphine in the tincture. The results agree well with those obtained by Dott's and by Teschemacher and Smith's processes.

The official process for the estimation of water in alkaloids consists in drying them by the heat of boiling water; in the case of morphine, as shown above, this temperature is not sufficient. In the case of the cinchona alkaloids and the salts of quinine, however, perfect desiccation may be obtained if sufficient time is given, but much time is saved by drying at 120°. Alkaloidal residues and extractive matters should always be dried in a flat-bottomed dish, so as to allow them to spread out in a thin layer.

The authors corroborate the statement of Cowney that *Quininæ sulphas* (official sulphate of quinine) gradually loses water of crystallisation on exposure to the air, until but 2 molecules are retained; also the anhydrous salt rapidly absorbs water, 1 gram on exposure to the air absorbed 0·015 gram of water in 7 minutes. They suggest that the sulphate with $2H_2O$ should replace the one now official in the British Pharmacopœia. *Quininæ hydrochloras*, when dried, is more hygroscopic than the sulphate, 0·626 gram, on exposure to the air, absorbed 0·017 gram of water in 6 minutes, and in 3 hours was converted into the salt with $2H_2O$. E. C. R.

New Methods of Testing Indigo. By B. WILLIAM GERLAND (*J. Soc. Chem. Ind.*, **15**, 15—17).—The process most in use, depending on reduction and the weighing of the recovered indigotin, is untrustworthy, since part of the indigotin is lost, and that which is recovered is very impure. The author makes use of the solubility of indigotin in hot nitrobenzene, and its almost complete separation on cooling (see Abstr., 1890, 311). The following simple extraction apparatus is employed. A test-tube 200 mm. long and 40 mm. diameter is clamped above a lamp. Centrally within it, the filter, consisting of a thin glass tube 45 mm. long and 20 mm. diameter, over the lower end of which calico, on which is placed a little paper pulp, is wired, is hung from a tube 8 mm. in diameter and 500 mm. long, which serves as a reflux condenser, and passes through a funnel resting on the mouth of the test-tube. It is connected with an aspirator, the action of which prevents escape of nitrobenzene vapour, and also the recondensation of any steam. Twenty-five c.c. of nitrobenzene, saturated in the cold with indigotin, is placed in the test-tube, and, by careful regulation of the flame and aspirator, the extraction of 0·5 gram of indigo is complete in ½—1 hour. The crystallised indigotin is collected on an extracted, weighed filter, washed with benzene, and dried. It still contains 3—6 per cent. of impurities, from which it can be freed by prolonged treatment with hydrochloric acid and hydrogen peroxide, being thereby rendered fit for weighing or for titration by Bernthsen's hyposulphite process. Owing to the solubility of indirubin in cold nitrobenzene, the total colouring matter is underestimated to the extent of about 0·1—0·2 per cent.

By heating indigo with sulphuric acid of 1·67 sp. gr. (40 c.c. to 0·5 gram) in a water bath for an hour, the idigotin is wholly converted into the monosulphonic acid, which dissolves, and can be separated from the residue by filtering through a sand filter with suction, and washing with acid of the same strength heated to 100°. On diluting the solution with 2 or 3 volumes of water, the monosulphonic acid is completely precipitated. It is best to collect it on a sand filter, and wash with water containing 20 per cent. of SO_3. It is then dried and digested at 100° with concentrated sulphuric acid, whereby it is converted into the disulphonic acid, which can be readily removed from the filter by water. It still, however, contains coloured impurities which vitiate the titration with hyposulphite. But if the raw indigo has been digested for some time in the cold with hydrochloric acid and hydrogen peroxide, then boiled, washed with boiling water and dried before treatment with sulphuric acid, the sulphindigotic acid is sufficiently pure to give good results on titration. The titration apparatus resembles that used by Tiemann and Preuss (Abstr., 1880, 138). The indirubin is estimated as indigotin, and the results are 0·3—0·4 per cent. higher than those obtained by the nitrobenzene process. M. J. S.

Estimation of Free Humic Acid in Peaty Soils. By Bruno Tacke (*Chem. Zeit.*, 1897, 21, 174—175).—The direct estimation of humic acid is impracticable on account of the colouring matters contained in the soils, but the author has devised an indirect process based on the decomposition of calcium carbonate by humic acid.

The apparatus consists of a generating flask furnished with a trebly perforated cork, through which pass three tubes; one of these is connected with a constant hydrogen apparatus, the second is fitted to an indiarubber tube with a screw-clamp, whilst the third is connected with a Pettenkofer's absorption tube.

The sample is put into the generating flask with 100 c.c. of boiled water, and a current of purified hydrogen is passed through the liquid for an hour to expel all the air; the absorption tube is then filled with 100 c.c. of N/10 soda, and an emulsion of calcium carbonate is introduced through the indiarubber tube. The current of hydrogen is kept up for 3 hours, when the contents of the absorption tube are titrated with N/10 hydrochloric acid, after adding barium chloride to precipitate the carbonate. The diminution in alkalinity represents the amount of carbonic anhydride given off by the calcium carbonate.

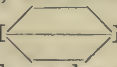
Although more carbonic anhydride is given off when the mixture is heated, the author thinks that the amount evolved in the cold is the true measure of the humic acid in the soil. L. de K.

Modification of Stutzer's Process for Estimating Proteids in Substances Rich in Starch. By Heinrich C. Tryller (*Chem. Zeit.*, 1897, 21, 54).—The sample is treated according to Stutzer's directions, but after adding the alum and the emulsion of copper hydroxide, it is allowed to cool to 65°, and 10 c.c. of a 20 per cent. malt-infusion is added. This rapidly liquefies the starch and facilitates the filtration.

The residue on the filter is then tested for nitrogen by Kjeldahl's process, allowance being made for any nitrogen contained in the malt solution and the filter paper. L. DE K.

General and Physical Chemistry.

New Lines in the Spectra of Oxygen and Thallium. By Henry Wilde (*Compt. rend.*, 1897, **125**, 708—709).—When a powerful electric spark condensed by means of a small Leyden jar is passed from thallium electrodes through air under a pressure of 20 atmos., three red lines are seen which are not visible when a similar spark is passed through nitrogen from platinum electrodes. Two of the lines, 7760 and 7160, are due to oxygen, and the third, 6955, to thallium. The oxygen line, 7160, is useful for detecting the presence of oxygen when separating argon from air by the sparking method. The conclusion of Stas, that the high temperature spectrum of thallium consists of a single line only, was due to the fact that he did not use a sufficiently powerful arc. The spectrum of thallium is the same whether observed in nitrogen or in air and therefore the lines and bands cannot be attributed, as Stas supposed, to thallium oxide. C. H. B.

Fluorescence and Chemical Constitution. By Richard E. Meyer (*Zeit. physikal. Chem.*, 1897, **24**, 468—508).—The fluorescence of organic compounds may be regarded as due to the presence of certain atomic groups which remain unchanged in the various fluorescent derivatives; these the author terms fluorphores or fluorphoric groups. In order, however, that the fluorescence may be developed, it is further necessary that the fluorphore be situated between two heavy atomic groups, usually benzene nuclei. In the derivatives of fluoran (Abstr., 1892, 970) embracing the fluoresceins, naphthofluorans, rhodamines, &c., the fluorphore is the pyrone group, which, although not fluorescent itself, becomes so in the diphenyl derivatives. The xanthones contain the same fluorphore, and the xanthens, its reduction product, and in all these groups of compounds the effect of substitution is very marked. In general, the entrance of heavy atoms or groups into the benzene nuclei diminishes the fluorescence, the effect being largely dependent on both nature and position of the substituent; thus the presence of hydroxyl groups in a position other than that of the fluorescein hydroxyls destroys or greatly weakens the fluorescence of the fluoran and xanthone compounds. In the anthracene group, only its direct derivatives, and not those of anthraquinone, are fluorescent. The acridine compounds contain the fluorphore CHN and the effect of the position of the substituent is here also very marked, benzoflavine which contains both amido-groups in the "fluorescein position" being far more strongly fluorescent than the isomeric chrysaniline. The substitution of sulphur for oxygen in the pyrone ring does not destroy its fluorphoric character, as the thiopyrone derivatives also exhibit weak fluorescence. The azine, oxazine, and thiazine rings also act as fluorphores in the phenazines, phenazoxines and thiodiphenylamine compounds, which include many important fluorescent dyes as mauveine, the safranines and allied naphthalene compounds, the indulines, Lauth's violet, and methylene-blue, which exhibits, although previously unrecorded, a reddish-violet fluorescence. The solvent has also a direct influence, as some compounds fluoresce strongly in some solutions, but not at all in others, and this difference is not always capable of being explained by dissociation changes.

L. M. J.

Conductivity of Electrolytes for very rapid Electrical Vibrations. By J. A. Erskine (*Ann. Phys. Chem.*, 1897, [ii], **62**, 454—459).—For vibrations of the period $1·3 \times 10^8$, the conductivity of the electrolytes examined agrees closely with that determined by Kohlrausch with the constant current. H. C.

Electrolytic Conductivity of Trichloracetic Acid. By Paul Rivals (*Compt. rend.*, 1897, **125**, 574—576).—The author has determined, by Bouty's method, the electrolytic conductivity of solutions of trichloracetic acid at 16° for degrees of dilution comprised between $\nu = 1$ litre and $\nu = 128$ litres, with the following results.

Values of ν.	Values of $\mu . 10^{-7}$.	Values of ν.	Values of $\mu . 10^{-7}$.	Values of ν.	Values of $\mu 10^{-7}$.
1 litre	178·3	4 litres	260·6	16 litres	289·5
2 litres	226·4	6 litres	268·5	32 litres	304·3
3 litres	247·5	8 litres	279·0	128 litres	317·0

μ can be represented as a function of ν, either by a parabolic formula, or more simply as a linear function of $1/\sqrt{\nu}$.

$$\mu = 331·7 \times 10^{-7} (1 - 0·463/\sqrt{\nu}).$$

If μ_∞, the limit of conductivity, has the value $\mu_\infty = 331·7 \times 10^{-7}$ and $m = \mu/\mu_\infty$, then m represents the proportion of acid dissociated and $m = 1 - 0·463/\sqrt{\nu}$.

Consideration of these results, together with the author's earlier determinations of the heat of dilution of trichloracetic acid at various concentrations, shows that the heat of dissolution and the degree of dissociation are both linear functions of $1/\sqrt{\nu}$, or, in other words, the heat of dilution is proportional to the fraction of acid dissociated. The molecular heat of electrolytic dissociation of trichloracetic acid is +4·17 Cal., and the heat of neutralisation by potassium hydroxide calculated on this basis by means of Ostwald's formula agrees closely with the experimental value. C. H. B.

Resistance and Specific Heat of some Oxides and Sulphides of Iron. By Antal Abt (*Ann. Phys. Chem.*, 1897, [ii], **62**, 474—481).—Prisms were cut of the following minerals, of the length in centimetres and cross-section in square millimetres given below, and the resistance r in ohms of each prism directly measured, and from this the resistance w for a prism of 1 centimetre length and 1 square centimetre area calculated in each case. The results are given in the table on following page.

The great difference in the magnetites is mainly due to the silica which they contain, as the resistance of quartz is very high.

Mineral.	Locality.	Length.	Area.	*r.*	*w*
Nickel ore N_1 ...	Dobsina	4·961	28·136	0·069	0·0032
,, ,, N_2 ...	,,	9·970	172·922	0·043	0·0074
Pyrrhotite P_1......	Alsó Jára	10·310	196·000	0·044	0·0084
,, P_2......	,,	10·030	196·000	0·052	0·0102
Chalcopyrite	Oláhlápos	14·600	196·000	0·758	1·0176
Pyrites	Felsöbánya	0·375	317·800	1·085	9·2000
Magnetite M_1......	Moravitza	14·596	196·000	52·560	7·0600
,, M_2......	,,	14·610	196·000	80·250	10·7600
,, M_3......	,,	0·086	295·333	2·860	97·8900
,, M_4......	,,	0·083	259·339	12·451	387·6400
,, M_5......	,,	0·082	257·732	45·608	1433·5100
,, M_6......	,,	9·948	193·000	8550·000	1684·5500
,, M_7......	,,	4·981	23·619	36500·000	1714·7100
,, M_8......	,,	16·630	201·640	36500 +	4400 +
,, M_9......	,,	14·590	196·000	36500 +	4900 +
Hæmatite H_1......	,,	4·987	24·682	29000·000	1430·5200
,, H_2	Kakukhegy (Hargitta)	0·115	54·780	1309·182	6214·6400
,, H_3......	Moravitza	14·475	177·956	36500 +	6500 +
Siderite	Dobsina	10·000	196·000	36500·000	7154·0000

The specific heats, *c*, of the following minerals were determined, their composition being at the same time ascertained by analysis.

Mineral.	SiO_2	Fe	S	O	*c*
Pyrrhotite	4·42	57·68	37·66	—	0·1539
Magnetite	5·72	68·10	—	25·93	0·1655
Hæmatite	2·13	67·15	—	28·78	0·1745
Nickel ore from Dobsina	—	—	—	—	0·1040

H. C.

Theory of Solutions. By Bronislaw Pawlewski (*Ber.*, 1897, **30**, 2805—2807).—The melting points of mixtures of paradibromobenzene and metachloronitrobenzene follow the normal course, the eutectic point 35·7° occurring with the mixture containing 32·99 per cent. paradibromobenzene, and 67·01 per cent. metachloronitrobenzene. Mixtures of paradibromobenzene and parachloronitrobenzene, on the other hand, are abnormal in their behaviour, as three distinct minima occur on the melting point curve. No explanation of this behaviour can be given. H. C.

Influence of Molecular Association on the Reduction of the Freezing Point and the Osmotic Pressure of Solutions. By Holland Crompton (*Ber.*, 1897, **30**, 2720—2725).—By combining the relation $rd/T = 0·099x/a$ (Trans., 1897, 925) with the van't Hoff equation for the reduction of the freezing point $E = 0·02T^2/r$, for monomolecular compounds $E/Td = 0·2$, and for associated compounds $E/Td = 0·2a/x$. Tables are given of the values of E/Td which show a fair agreement with theory in the case of the monomolecular compounds, but discrepancies are observed among the associated compounds. To account for the latter, the view is advanced that van't Hoff's equation should be modified when the solvent used is associated, and that for associated as well as for monomolecular solvents, $E/Td = 0{\cdot}2$.

H. C.

Densities of Easily Liquefiable Gases. By Anatole Leduc (*Compt. rend.*, 1897, **125**, 571—573).—The following results were obtained.

Carbonic anhydride	1·5287	Chlorine	2·491
Nitrous oxide	1·5301	Ammonia	0·5971
Hydrogen sulphide	1·1895		

The author's previous determinations have given 1·2692 for hydrogen chloride and 2·2639 for sulphurous anhydride. All these determinations the author regards as less exact than those that he has made with gases difficult to liquefy. For example, the condensation of the gas on the walls of the glass vessel introduces an error the magnitude of which cannot be calculated.

C. H. B.

Dissociation of Saline Hydrates and Analogous Compounds. By Henri Lescœur (*Ann. Chim. Phys.*, 1896, [vii], **19**, 213—234, 416—432 and 537—550. Compare Abstr., 1889, 815; 1893, ii, 364; 1894, ii, 343, and 1895, ii, 269).—The following have been examined: Lithium, cadium, manganese, cobalt, nickel, ferrous and uranium sulphates; strontium, magnesium, zinc, cadmium, manganese, cobalt, nickel, copper, bismuth, and uranium nitrates; potassium carbonate, potassium hydrogen carbonate, borax, normal potassium oxalate, potassium ferrocyanide, and sodium thiosulphate.

The author points out the necessity of crystallising the sulphates from a perfectly neutral medium, as minute quantities of free sulphuric acid change the nature of the hydrates formed. The same applies to the nitrates.

	Hydrate formed from neutral solution.	Compound precipitated by addition of sulphuric acid.
Sodium sulphate	$Na_2SO_4 + 10H_2O$	Slight turbidity only.
Potassium ,,	K_2SO_4	$KHSO_4$.
Ammonium ,,	$(NH_4)_2SO_4$	NH_4HSO_4
Magnesium ,,	$MgSO_4 + 7H_2O$	Slight turbidity.
Zinc ,,	$ZnSO_4 + 7H_2O$	$ZnSO_4 + H_2O$.
Cadmium ,,	$CdSO_4 + 4H_2O$	$CdSO_4 + H_2O$.
Manganese ,,	$MnSO_4 + 5H_2O$	$MnSO_4 + H_2O$.
Ferrous ,,	$FeSO_4 + 7H_2O$	$FeSO_4 + H_2O$.
Nickel ,,	$NiSO_4 + 6H_2O$	$NiSO_4 + H_2O$.
Cobalt ,,	$CoSO_4 + 7H_2O$	$CoSO_4 + H_2O$.
Uranium ,,	$UO_2SO_4 + 3H_2O$	$UO_2SO_4 + H_2O$.

The sulphates, with the exception of sodium sulphate, resemble one another in the fact that they yield hydrates $MSO_4 + H_2O$. This hydrate, as a rule, is only dissociated at a fairly high temperature.

The hydrate $CaSO_4 + \frac{1}{2}H_2O$ begins to dissociate at about 100°, and the hydrate, $CuSO_4 + 3H_2O$, at 100°, has a tension of 525 mm.

The maximum tensions at 20° of saturated solutions are

Zinc sulphate	about	15·3 mm.	Cobalt sulphate	about	13·7 mm.
Copper ,,	,,	15·2 ,,	Cadmium ,,	,,	12·9 ,,
Ammonium sulphate	,,	14·8 ,,	Lithium ,,	,,	12·4 ,,
Magnesium ,,	,,	14·5 ,,	Sodium ,,	,,	12·0 ,,
Potassium ,,	,,	14·4 ,,	Manganese,,	,,	11·8 ,,
Nickel ,,	,,	14·4 ,,	Uranium ,,	,,	10·8 ,,

The most common hydrate met with among the nitrates is that with $6H_2O$. A second type is with $3H_2O$ which is generally formed by the dehydration of the first type. The maximum tensions, at 20°, of saturated solutions are

Potassium nitrate	about	15·0 mm.	Zinc nitrate	about	9·6 mm.
Barium ,,	,,	14·8 ,,	Cobalt ,,	,,	9·3 ,,
Strontium ,,	,,	14·6 ,,	Calcium ,, ($4H_2O$)	,,	9·3 ,,
Sodium ,,	,,	11·15 ,,	Nickel ,,	,,	8·5 ,,
Ammonium ,,	,,	9·1 ,,	Copper ,,	,,	7·9 ,,
Uranium ,,	,,	12·2 ,,	Manganese nitrate	,,	7·4 ,,
Cadmium ,,	,,	10·0 ,,			

J. J. S.

Osmotic Pressure and Electrolytic Dissociation. By ISIDOR TRAUBE (*Ann. Phys. Chem.*, 1897, [ii], **62**, 490—506).—If in one litre of the co-volume of any liquid there are present N gram-molecules, as the author has shown in previous papers, the pressure will be 22·38N atm. If we imagine water and a sugar solution separated by a semi-permeable membrane, the water containing N molecules per litre co-volume and the sugar solution N molecules of water to ν molecules of sugar, the ν molecules may, according to the author's view, be considered to enter into unstable union with a molecules of water, thus producing the observed contraction in volume, and the number of water particles which will enter the membrane from the two opposite sides will be $N:(N-a\nu)$. Hence on the side of the solution the pressure will be less than that on the side of the water by 22·38 $a\nu$ atm. If $a=1$ the observed pressure accords with the van't Hoff theory, and, therefore, the diminution in pressure on the side of the solution, due to the union of the dissolved substance and the water, is the osmotic pressure. Poynting (*Phil. Mag.*, 1896, [v], **42**, 289) has already shown that, assigning this origin to the osmotic pressure, the majority of the observed relations are at once accounted for. The exceptions observed in the case of electrolytes are explained by variations in the value of a, and it is unnecessary to assume electrolytic dissociation in these instances.

H. C.

Causes of Osmotic Pressure and of the Simplicity of the Laws of Dilute Solutions. By WILLIAM SUTHERLAND (*Phil. Mag.*, 1897, [v], **44**, 493—498).—The reasons usually assigned for the fact that the laws of the osmotic pressure of a solute in a solvent are the same as if the solvent were annihilated and the solute left as a perfect gas, are quite inadequate, because they would apply to any selected lot of the molecules of a solvent, and therefore to all the molecules, with the result that the laws of a perfect gas would have to hold for all fluids down to and in the liquid state (compare Speyers, Abstr., 1897, ii, 247). The answer to the problem is to be found in a closer study of the semipermeable membrane. If we seek to picture to ourselves how a membrane allows water molecules to pass, but not sugar molecules, our simplest conception of its structure is that of a mesh, amidst the threads of which the water molecules are packed in such a manner as to give way before one another almost as in ordinary water, whilst the sugar molecules are held back by the mesh. Thus the mesh forms a solid or quasi-solid framework through which water can pass with high viscous resistance, whilst the sugar molecule is absolutely blocked. Now if the framework turns back the sugar molecules, it must take the force of their blows and shield the water molecules from them. If, then, we suppose a semipermeable membrane separating water and a dilute solution of sugar in water, the sugar molecules are to be regarded as replacing some water molecules, but their collisions on the water in the membrane are rendered inoperative by the shielding action of the framework, so that the water molecules in the membrane receive more impacts on the side of the pure water than on the side of the solution, and therefore water flows through the membrane, until in the solution there is enough excess of hydrostatic pressure established to compensate for the inoperative impacts of the sugar molecules; this inequality of pressure which can be hydrostatically balanced is the osmotic pressure.

If the number of sugar molecules per unit volume is n and their mean velocity v, and the number of times a unit plane is crossed in the same direction by molecules per second is $nv/6$, then, taking unit area on the surface of the semipermeable membrane in contact with the dilute sugar solution, each molecule in being turned back receives momentum $2mv$, so that the whole pressure taken by unit area of the meshes of the membrane is $nmv^2/3$. Thus for the osmotic pressure we find the same expression as for the gas pressure of the sugar molecules if the water were annihilated and the sugar remained as a perfect gas.

H. C.

Real and Apparent Freezing Points and the Freezing Point Methods. By MEYER WILDERMANN (*Phil. Mag.*, 1897, [v], 44, 459—486).—See Abstr., 1896, ii, 290.

Expansion during the Dissolution of Ammonium Salts. II. Ethyl Derivatives. By HUGO SCHIFF and U. MONSACCHI (*Zeit. physikal. Chem.*, 1897, 24, 513—521).—The authors have extended their previous researches (Abstr., 1897, ii, 89) to the ethyl derivatives of ammonium chloride, and have determined the expansion during the dissolution of ethyl-, diethyl-, triethyl-, and tetrethyl-ammonium chlorides. For all these salts, expansion occurs during aqueous dissolution; in a 65 per cent. solution of ethylammonium chloride, this expansion reaches 0·07 of the volume of the mixed constituents. The curves for specific gravity against concentration and expansion against concentration are given, those for the monoethyl derivative being seen to agree very closely with that for ammonium chloride itself. For tetrethylammonium chloride, a maximum expansion occurs when the concentration is about 50 per cent. The effect of dissolution in alcohol was only examined in the case of diethylammonium chloride, and here a contraction occurred. L. M. J.

Compressibility of Salt Solutions. By HENRI GILBAULT (*Zeit. physikal. Chem.*, 1897, **24**, 385—440. Compare Abstr., 1892, 766).—For the determination of the compressibility at temperatures not far removed from that of the atmosphere, a modification of Cailletet's method was employed, the difference being the use of a gold-coated platinum wire inserted in the neck of the piezometer to indicate the contraction instead of gilding the interior of the piezometer itself. Researches with water and solutions of iron salts indicate the availability and accuracy of the method. For high temperatures, the author used a cylindrical tube immersed horizontally in a bath of glycerol, the pressures being in all cases taken with a hydrogen manometer. In order to extend the observations to temperatures approaching the critical values, experiments were made with solutions of benzoic acid and of borneol in ether, and of resorcinol in ethylic alcohol, and the critical data of the various solutions were therefore first determined, curves of critical temperature, and critical pressure against molecular concentration being given. The mixture law of Pawlewski is not obeyed, since at low concentrations a small quantity of salt causes a relatively great alteration of the critical temperature or pressure, the curves becoming nearly perpendicular to the axis of concentration. The curves for the solutions of borneol and of benzoic acid are almost identical, so that the author concludes that the change of critical temperature is only dependent on the molecular concentration and not on the nature of the dissolved substance. Tables are first given for the volumes, at various pressures, of ether and ethereal solutions of benzoic acid at 139·5—212·1°, and of water and aqueous solutions of potassium iodide at 20°; and in all cases the compressibility decreases with increase of pressure. Van der Waals' expression is insufficient, and the author finds that the expression giving the best agreement with the experimental numbers is $v = -1/M.k\log(p-A) + Bp + C$ where A, B, C and k are constants at constant temperature. The calculated and observed values are found to agree well for pressures up to 250 atmospheres in the case of aqueous solutions at ordinary temperatures, and ethereal and alcoholic solutions near their critical temperatures.

The influence of temperature on the compressibility of ethereal and alcoholic solutions was next considered, and the author obtains the following expression for the compressibility coefficient,

$$\gamma = \frac{a - b + p/\pi}{(\theta - T)/T + d(p - \pi)/\pi}$$

where θ is the absolute critical temperature, π the critical pressure, and a, d, and b constants. This expression gives satisfactory agreement with the observed numbers for all the solutions examined. As the values a, b, and d are identical for solvent and solution, it is evident that the law of corresponding states applies to the solutions, since the compressibility depends only on the ratios p/π and θ/T. In the above case, the compressibility increases with the temperature, but with water at ordinary temperatures the reverse obtains, and the author finds the temperature of minimum mean compressibility (1—300 atms.) to be about 63·5°. In the case of salt solutions at low concentrations, similar results are found, but at certain concentrations the compressibility remains practically constant over a considerable range of temperature. To investigate the effect of concentration, solutions of sodium chloride were employed; the compressibility decreases as the concentration increases, but the curve is not a straight line, being slightly convex to both axes. The author gives the term "molecular compressibility" to the volume decrease of the solution containing the same number of molecules as 100 grams of water; and assuming complete dissociation of the dissolved substance and the value 18 as the molecular weight of water, obtains the equation $(\log\mu_0 - \log\mu)d/a = k$ where μ_0 and μ are the molecular compressibilities of water and solution, d is the density, a the ion concentration, and k a constant dependent only on the nature of the dissolved substance. This constant appears to be connected with the molecular volume contraction on dissolution in much water, as the magnitudes of both constants are in the same order for a series of 18 salts examined, and a formula connecting the two constants is given. L. M. J.

Equilibrium in Solutions with Three Components:—β-Naphthol, Picric Acid, and Benzene. By Basil B. Kuriloff (*Zeit. physikal. Chem.*, 1897, **24**, 441—467).—In the equilibrium of the above system, the following solid phases may occur, β-naphthol, picric acid, benzene, β-naphthol picrate, and benzene picrate; preliminary experiments indicated the absence of any ternary phase. The transition point of the β-naphthol picrate on the β-naphthol side is 111°, and on the picric acid side 116°, that of benzene picrate being 84·3°; hence, representing the equilibrium as usual in the equilateral triangle, the isothermals above 116° are complete curves with the binary solid phase of the naphthol picrate. Between 111° and 84°, they form three portions corresponding with the phases β-naphthol, β-naphthol picrate, and picric acid, whilst below 84° the last portion corresponds with the phase benzene picrate. Three quintuple points occur where three solid phases co-exist, namely, (1) picric acid, β-naphthol picrate, and benzene picrate; (2) benzene picrate, β-naphthol picrate, and benzene; and (3) β-naphthol, β-naphthol picrate, and benzene, and the temperatures and composition of solution at these points are given with the complete isothermals at various different temperatures. L. M. J.

[Formation and Changes of Solids.] By F. Wald (*Zeit. physikal. Chem.*, 1897, **24**, 509—512).—In a paper on the formation and changes of solids, Ostwald states that, during a transition from a particular state to one of greater stability, the change is not necessarily to the most stable, but to the nearest (Abstr., 1897, ii, 308). The author discusses this statement, and considers it is not based upon sufficient theoretical foundations to be given as a general law. L. M. J.

Velocity and Rate of Recombination of the Ions of Gases exposed to Röntgen Radiation. By E. Rutherford (*Phil. Mag.*, 1897, [v], **44**, 422—440).—Air which has been exposed to Röntgen radiation preserves the power of discharging positive and negative electrification a short time after the rays have ceased. The duration of the after-conductivity of air and other gases has been investigated, and from the data thus obtained, the velocity of the ions through various gases has been determined.

The following table gives the times, *T*, for the number of ions to fall to half their original number.

Gas.	*T* in seconds.	Conductivity. Air=1.
Hydrogen	0·65	0·5
Air	0·3	1
Hydrogen chloride	0·35	11
Carbonic anhydride	0·51	1·2
Sulphurous anhydride	0·45	4
Chlorine	0·18	18

There seems to be no close connection between the values of *T* and the conductivities, although, as a general rule, it may be taken that the value of *T* diminishes with increase of conductivity. The value of *T* for the same gas was found to depend largely on the intensity of the radiation; and the presence of finely-divided matter, liquid or solid, affects the duration of the after-conductivity.

The velocities of the ions were found to be independent of the amount of ionisation of the gas, and, with the exception of chlorine, to follow the inverse order of the densities. The velocity of the hydrogen ion through hydrogen is nearly four times as fast as the velocity of the oxygen ion in oxygen. The ions of sulphurous anhydride gave the slowest velocity, being only about one-tenth of that of hydrogen. H. C.

Table of the Elements arranged with the Atomic Weights in Multiple Proportions. By HENRY WILDE (*Compt. rend.*, 1897, **125**, 707).

[Boring Holes in Glass.] By H. JERVIS (*Chem. News*, 1897, **76**, 211—212).—Holes may be bored in glass by making a stellate group of cross scratches with the point of a three-cornered file, and then working out the glass with the sharp corners of a newly-broken end of such a file, most conveniently fitted in a brace. In all cases the tool must be moistened with turpentine. D. A. L.

Inorganic Chemistry.

Influence of Hygroscopic Substances on the Combination of Hydrogen and Oxygen. By MARCELLIN P. E. BERTHELOT (*Compt. rend.*, 1897, **125**, 675—679).—Hydrogen chloride has no appreciable influence on the combination of oxygen and hydrogen at 100° or at 280°. Boron fluoride seems to slightly retard combination, but this result is probably due to alteration in the surface of the glass, which is somewhat strongly attacked. Sulphurous anhydride is without influence at 100°, but at 280°, although the volume of the hydrogen remains unchanged, a notable quantity of oxygen is absorbed, and alkali sulphates are formed from the alkalis in the glass.

In presence of sulphuric acid at 280°, all the hydrogen is absorbed, and part of the sulphuric acid is reduced. A small quantity of oxygen also disappears, probably because it combines with the sulphurous anhydride.

Phosphoric anhydride seems to be without influence on the combination of hydrogen and oxygen at any temperature up to 280°, and even at this temperature the absorption of the water as fast as it is formed has no marked influence on the rate of combination. (Compare Abstr., 1897, ii, 548.) C. H. B.

The Ammonia of the Atmosphere. By REINHOLD HEINRICH (*Ann. Agron.*, 1897, **23**, 485—486; from *Ber. Landw. Versuchs-Stat. Rostock*, 1894, **2**, 10).—The ammonia present in the air was absorbed by means of dilute hydrochloric acid in glass vessels 5 cm. high and 10 cm. in diameter, which were protected from rain. Ammonia was determined monthly. The greatest amount (4·061 milligrams) was found in June, the lowest (0·854 milligram) in February. Taking the different seasons, the amounts were: winter, 2·912; spring, 6·712; summer, 9·766, and autumn, 4·678 milligrams. The total amount for the year was 24·066 milligrams. N. H. J. M.

Preparation of Nitrogen Chloride. By W. HENTSCHEL (*Ber.*, 1897, **30**, 2642. Compare Abstr., 1897, ii, 404 and 447).—Attempts to modify the method of preparing nitrogen chloride from ammonium chloride by substituting bleaching powder for sodium hypochlorite have hitherto been unsuccessful, owing to the liberation of gas from the solution. This difficulty is overcome by employing hydrochloric acid, which prevents evolution of gas. A 10 per cent. solution of nitrogen chloride in benzene is prepared in the following manner.

3000 c.c. of a solution of bleaching powder, containing 22·5 grams of active chlorine per 1000 c.c., is gently agitated in a stoppered flask of 5000 c.c. capacity, and cautiously treated with a 10 per cent. solution of hydrochloric acid until a portion of the solution no longer yields gas when mixed with excess of a 20 per cent. solution of ammonium chloride. About 300 c.c. of the dilute acid is usually required for this purpose, and when the proper quantity has been added, the liquid is treated with 300 c.c. of a 20 per cent. solution of ammonium chloride, and then vigorously agitated with 300 c.c. of benzene during 30 seconds, the liquid meanwhile being protected from light; the benzene is separated from the aqueous liquid, and transferred to a folded filter containing 20 grams of crushed calcium chloride.

M. O. F.

Action of Sulphur on Silicides. Production of Silicon. By GUILLAUME J. L. DE CHALMOT (*Amer. Chem. J.*, 1897, **19**, 871—877).—The author finds that the combined silicon of the copper silicide previously described by him (Abstr., 1897, ii, 262), may be partially liberated by acting on it with sulphur; the action begins at 200—250° and may be completed at 270—280°. Cuprous or cupric sulphide is produced according to the quantity of sulphur used, and a little silicon sulphide is also formed; above 300°, however, the latter is obtained in larger quantity. The percentage of free silicon in two alloys containing originally 19·21 and 1·22 per cent. was increased to 25·77 and 7·27 respectively, by heating with sulphur at temperatures below 290°.

Manganese silicide is much less readily attacked by sulphur; below 300°, there is practically no action, whilst at the boiling point of sulphur, although some silicon sulphide is formed, no free silicon is liberated.

Chromium silicide is not attacked by sulphur at 300°, but at 450° some action seems to occur, although no silicon is liberated.

Iron silicide containing 29·51 per cent. of combined, and no free, silicon is not attacked by boiling sulphur. E. W. W.

Metallic Carbides which are Decomposed by Water. By HENRI MOISSAN (*Ann. Chim. Phys.*, 1896, [vii], **19**, 302—337).—A *résumé* of previous papers. Compare Abstr., 1894, ii, 450; 1896, i, 633; ii, 364, 419, 422, 423, 650. J. J. S.

Volatilisation of Refractory Substances. By HENRI MOISSAN (*Ann. Chim. Phys.*, 1896, [vii], **19**, 133—144).—The whole of this work has been published previously. Compare Abstr., 1893, ii, 507, 532; 1894, ii, 42, and 1895, ii, 164. J. J. S.

Atomic Weights of Argon and Helium. By HENRY WILDE (*Compt. rend.*, 1897, **125**, 649—651).—Under low pressures at −76°, and at 20 atmos., nitrogen does not yield the spectrum of argon, nor argon the spectrum of nitrogen, even if the discharge is continued for several hours.

The author discusses the possible positions of argon and helium in his systematic arrangement of the elements according to their atomic weights. C. H. B.

Lithium Chloride Solutions. By GEORGES LEMOINE (*Compt. rend.*, 1897, **125**, 603—605).—The sp. gr. at 0° of solutions of lithium chloride of various concentrations is as follows.

Weight of salt in 100 grams of solution	4·26	12·18	22·2	32·5	41·4	43·2
Sp. gr.	1·026	1·073	1·133	1·203	1·267	1·282

These results are more accurately represented by two right lines, than by a continuous curve, and there seems to be a modification in the constitution of the solution from about 13 gram-molecules per litre to about 6 gram-molecules per litre, or from $LiCl + 3H_2O$ to about $LiCl + 8H_2O$.

The heats of dilution at 10° are as follows.

Gram-molecules of LiCl per litre	12	9	6	3	1	0·5
Heat of dilution, starting from 12 gram-molecules per litre	0	1·3	2·2	2·8	3·1	3·2 Cal.
Heat of dissolution taking 8·4 Cal. as maximum	5·2	6·5	7·4	8·0	8·3	8·4 ,,

There is no development of heat beyond $LiCl + 116H_2O$, and the results are practically the same at 20° as at 10°. The heat of dilution increases regularly with the quantity of water.

Lithium chloride and methylic alcohol :—

Temperature	1°	23°	50°
Ratio of the weight of salt to the weight of the saturated solution	0·261	0·27	0·30
Weight of salt in 100 grams of solution	5·2	14·5	22·1
Sp. gr. at 21·5°	0·836	0·910	0·974
Sp. gr. at 0°	0·854	0·926	0·988

Gram-molecules of LiCl per litre	5	3	1	0·5
Molecules of MeOH per molecule of LiCl	4·7	7·9	24	48
Heat of dilution at 18° from 5 gram-molecules per litre	0	1·5	2·6	3·0 Cal.
Heat of dissolution taking 10·9 as maximum	7·9	9·4	10·5	10·9 Cal.

There is no development of heat beyond LiCl + 48MeOH.

Lithium chloride and ethylic alcohol.—Determinations of solubility gave

Temperature	1·6°	5·7°	13·0°	25·0°	40·6°	62·6°
Ratio of weight of salt to weight of its saturated solution	0·14	0·14	0·13	0·14	0·15	0·18

These results are represented by two right lines which intersect at a low angle, at a point corresponding with 30°, the more inclined portion leading slowly to the melting point of the salt. The solubility decreases, progressively in the order : water, methylic alcohol, ethylic alcohol, amylic alcohol.

Weight of salt in 100 grams of solution	5·2	10·1	14·6
Sp. gr. at 14·2	0·839	0·871	0·903
Sp. gr. at 0°	0·851	0·881	—

Gram-molecules of LiCl per litre	3	2	1	0·5
Molecules EtOH per molecule LiCl	5·4	8·3	16·9	35
Heat of dilution from 3 gram-mols. per litre	0	—	2·1	2·6 Cal.
Heat of dissolution taking 11·7 as maximum	9·1	—	11·2	11·5 Cal.

C. H. B.

Colloidal Silver. By C. A. Alfred Lottermoser and Ernst von Meyer (*J. pr. chem.*, 1897, **56**, 241—247).—The authors propose to study quantitatively the action of various reagents on colloidal silver. They find that acids precipitate it from solution in the "molecular" state, time and dilution being of great importance ; also with different acids widely different results are obtained, as is seen from the results of quantitative experiments already completed.

Colloidal silver is not precipitated by small amounts of sodium chloride or hydrochloric acid in presence of albumin. Apparently no silver albuminate is formed, but further details of these experiments, as also of those on the action of salts and the halogens on colloidal silver will be given subsequently. A. W. C.

Calcium, Barium, and Strontium Borides. By Henri Moissan and P. Williams (*Compt. rend.*, 1897, **125**, 629—643).—Calcium boride is best obtained by heating an intimate mixture of 1000 parts of calcium borate, 630 parts of aluminium and 200 parts of sugar carbon in a carbon crucible for 7 minutes with a current of 900 ampères and 45 volts. The aluminium completely reduces the calcium borate, whilst the carbon prevents the formation of aluminium oxide. The product is broken up and heated successively with dilute hydrochloric acid, boiling concentrated hydrochloric acid, water, ether, toluene, and hydrofluoric acid.

The calcium boride has the composition CaB_6 and forms transparent, microscopic cubic or rectangular crystals which scratch rock crystal, and even rubies; sp. gr. = 2·33 at 15°. It is not altered when heated to redness in hydrogen, is attacked by fluorine in the cold, with incandescence, by chlorine at a red heat, and also, but more slowly, by bromine and iodine. When heated in air, it does not burn below a bright red heat, and it is attacked by sulphur vapour under the same conditions. Nitrogen does not attack it even at 100°, and it is not decomposed by water under pressure at 250°, and even in a current of steam at higher temperatures decomposition is very slow. Gaseous halogen hydracids attack the boride at a dull red heat, but their solutions have no action on it; dilute sulphuric acid also does not attack it, but the concentrated acid is reduced. Ammonia is without action on the boride at the softening point of glass. On the other hand, oxidising agents, whether fused or in solution, attack it readily.

Strontium boride, SrB_6, is obtained in a similar way and has similar properties, but is not attacked by fluorine in the cold; sp. gr. = 3·28 at 15°.

Barium boride, BaB_6, is also obtained in the same way, and its properties are similar; it forms small but very regular crystals which scratch rubies, but not diamonds; sp. gr. = 4·36 at 15°. The yield of boride is greater than with calcium or strontium. C. H. B.

Basic Magnesium Salts. By TASSILLY (*Compt. rend.*, 1897, **125**, 605—607).—Precipitated magnesium hydroxide yields no oxybromide when heated with solutions of magnesium bromide. If, however, 5 grams of magnesium oxide previously heated at a low temperature is added gradually to an almost boiling solution of 145 grams of magnesium bromide in 300 grams of water, and the solution is again heated, finally, to 150°, and then filtered and allowed to cool, the oxybromide, $MgBr_2,3MgO + 12H_2O$ separates after about 15 days in small, acicular crystals which act on polarised light and show longitudinal extinction. When heated at 120° in dry air free from carbonic anhydride, the crystals lose $6H_2O$. The oxybromide alters when exposed to air, and absorbs carbonic anhydride; it is decomposed by water, alcohol, and most other reagents.

No definite oxyiodide could be obtained under similar conditions.

C. H. B.

Zinc Hydroxide in Precipitation. By VERNON J. HALL (*Amer. Chem. J.*, 1897, **19**, 901—912).—The author has studied the precipitation of zinc hydroxide by means of potassium hydroxide solution, with reference to its effect in carrying down chlorine. When used in the ratio $2KHO : ZnCl_2$, no chlorine is found in the precipitate, whereas with

$1\frac{1}{2}KHO$, 7·4 per cent. of the total chlorine is obtained in the precipitate, and the quantity decreases as the proportion of potassium hydroxide is diminished. When the ratio is 5—$8KHO : ZnCl_2$, no chlorine is carried down. Experiments made on precipitation in presence of potassium sulphate led to results similar to those obtained in the case of the precipitation of ferric hydroxide (Abstr., 1897, ii, 408). Increase of concentration tends to diminish the quantity of zinc precipitated and to increase the quantity of chlorine in the precipitate, whereas in the case of ferric hydroxide both the quantity of ferric oxide and chlorine in the precipitate decrease with increased concentration; in both cases, however, rise of temperature greatly reduces the quantity of metallic oxide and chlorine thrown down. E. W. W.

Impurities in Crude Copper. By FRÉDÉRIC SCHLAGDENHAUFFEN (*Compt. rend.*, 1897, **125**, 573—574).—When water is allowed to remain in contact with filings of crude English or Chili copper for several days, it yields a yellow precipitate if acidified with hydrochloric acid and treated with hydrogen sulphide, the precipitate being more abundant if the copper and water are heated at 100°. If the same filings are afterwards treated with potassium hydroxide solution or dilute hydrochloric acid, both arsenic and antimony are found in the solution. Further, if the filings are heated in a current of carbonic anhydride, a mixture of arsenic and antimony oxides sublimes. Some other specimens of crude copper gave a sublimate which contained selenium, whilst one specimen gave a sublimate of lead sulphide in cubical crystals.

C. H. B.

Solubility of Lead in Ammonia. By HERMANN ENDEMANN (*Amer. Chem. J.*, 1897, **19**, 890—893).—Strong ammonia does not dissolve litharge, although Karsten states that lead dissolves in ammonia, forming a dark yellow solution. If lead be immersed for a day in strong ammonia solution (29 per cent.), there is no apparent change, but the solution contains some lead; if left for a longer time, the lead becomes coated with an orange, and later with a rust-coloured, precipitate, whose dark colour quickly fades if the precipitate is detached from the metal. After three days, the ammonia contains 0·0139 per cent. of lead, and if the action be allowed to continue for weeks, a white precipitate, which appears to be lead hydroxide mixed with oxides of other metals, is formed on the bottom and sides of the vessel. After drying, this precipitate contains only 0·15 per cent. of ammonia. Weak ammonia solution (2·9 per cent.) brings about a more rapid oxidation, for in 24 hours a white precipitate is formed on the glass, and on the surfaces of the liquid and the lead, and during the next 48 hours it rapidly increases in amount. The bearing of these observations on the manufacture of ammonia solution in lead-lined tanks, and the contamination of potable waters, is briefly discussed.

E. W. W.

Researches on Aluminium. By HENRI MOISSAN (*Ann. Chim. Phys.*, 1896, [vii], **19**, 337—356).—A *résumé* of work previously published. Compare Abstr., 1894, ii, 450; 1895, ii, 226; 1896, ii, 301, 338 and 601. J. J. S.

Chromium Arsenate. By N. Tarugi (*Gazzetta*, 1897, **27**, ii, 166—175).—Schweitzer ascribed the composition, $K_8Cr_3As_6O_{28},20H_2O$, to the compound obtained by treating potassium chromate with arsenious acid. The author considers that, at ordinary temperatures, the salt has the constitution $[Cr(OH)_4:AsO_4]_2Cr(OH)_4,4K_2HAsO_4,12H_2O$, after heating at 60° the constitution

$$(CrO_2:AsO_4)_2CrO_2,4K_2HAsO_4,10H_2O,$$

whilst by heating at 120° the $10H_2O$ is expelled; these constitutions are assigned on the basis of determinations of water of crystallisation. The *compound* of the composition $K_8Cr_3As_6O_{30}H_4$, obtained at 120°, is a green powder which, when boiled with potash, yields a pale green *substance* of the composition $K_4Cr_3As_2O_{16},12H_2O$, to which the constitution $(K_2AsO_4\cdot CrO_2\cdot O)_2CrO_2$ is assigned; when boiled with potassium hydrogen arsenite solution, it yields a *substance* of the composition $K_7As_5Cr_3O_{22},24H_2O$ and the constitution

$$[Cr(K_2AsO_4):KAsO_4\cdot O]_2Cr(KAsO_4),24H_2O.$$

This, on boiling with potash, yields the compound

$$[Cr(HO)_2(K_2AsO_4)\cdot O]_2Cr(HO)_2,$$

which on heating at 150° is converted into a *compound* of the constitution $[CrO(K_2AsO_4)\cdot O]_2CrO$; on treating the latter with potassium hydrogen arsenite, it yields a substance of the constitution

$$[Cr(K_2AsO_4):AsO_4]Cr_2,$$

which is readily oxidised by potassium ferricyanide with formation of *chromium arsenite*, $AsO_4\vdots Cr\cdot AsO_4:Cr:AsO_4\cdot Cr\vdots AsO_4$, as a dark green powder.

W. J. P.

Stannic Acids. By Rodolphe C. Engel (*Compt. rend.*, 1897, **125**, 651—654).—The author gives a *résumé* of the recorded observations concerning stannic and metastannic acids, and of the results of his own investigations (Abstr., 1897, ii, 376, and this vol., ii, 29).

C. H. B.

Action of Nitric Acid on Tin. By Rodolphe C. Engel (*Compt. rend.*, 1897, **125**, 709—711).—The white product of the action of nitric acid on tin has been variously described as stannic acid (Gay Lussac), metastannic acid (Berzelius, Fremy), stannic nitrate (Montemartini), and basic stannic nitrate (Walker). The author finds that the nature of the product depends on the conditions under which it is formed. If nitric acid of sp. gr. 1·42 is diluted with different proportions of water, kept at 0°, and a stick of tin immersed in 200 c.c. of the liquid, the products are (*a*) with 1 vol. of nitric acid and 2 vols. or more of water, stannous nitrate; (*b*) with equal volumes of water and acid, stannic nitrate, the liquid finally becoming syrupy; and (*c*) with undiluted acid, stannic nitrate, which, however, is precipitated, because it is insoluble in moderately concentrated nitric acid.

Stannic nitrate is, however, readily decomposed by water or by a rise of temperature, the first product being stannic acid mixed with a small proportion of metastannic acid, the proportion of the latter increasing, however, if the substance remains in contact with water, or if it is dried. The limiting compound in the cold is metastannyl stannate.

When metastannyl stannate is boiled with water, the conversion into metastannic acid proceeds further, and parastannic acid is also formed in gradually increasing quantity (this vol., ii, 29). Pure metastannic acid yields parastannic acid when boiled with water; the latter may perhaps be regarded as an internal anhydride of the former. Metastannic acid is not formed by the direct action of nitric acid on tin; the substance described by Berzelius was in reality parastannic acid. C. H. B.

Mineralogical Chemistry.

Native Iron in the Coal Measures of Missouri. By Eugene T. Allen (*Amer. J. Sci.*, 1897, [iv], 4, 99—104).—Very few well-authenticated occurrences of terrestrial iron, which may not possibly be artificial or meteoric, have been described. It has been stated to be found in igneous rocks, in river sands, and in connection with carbonaceous matter. Analysis I is of native iron from a boring in sandstone (containing 30·90 per cent. of calcareous cement and 1·27 per cent. Fe_2O_3) at Cameron, Clinton Co. The iron occurs in irregular fragments weighing on an average 0·5 gram, the largest weighing 45·4 grams; it is soft (H = 4), very malleable, and on the fresh fracture almost silver-white. A well-marked, laminated cleavage is present, but no Widmanstätten figures are brought out by etching. Analysis II is of pieces of iron from a grey clay (containing 79·32 SiO_2 and 1·67 Fe per cent.) in a boring passing through sandstone and lignite at Weaubleau, Hickory Co. III is of iron from fire-clay (containing 65·25 SiO_2 and 3·62 Fe per cent.) in a boring, passing through a coal bed, at Holden, Johnson Co.

	Fe.	SiO_2.	C.	P.	Cu, Ni, Co.	Sp. gr.
I.	99·16	0·37	0·065	0·207	Nil	7·63—7·73, 7.43
II.	99·39	0·31	not det.	0·13	—	7·58, 7·83, 7·88
III.	97·10	1·65	not det.	0·176	—	7·49

These specimens of iron, when first extracted from the matrix, are tarnished, but are free from rust; they are very soft, and contain no nickel. The depth (35—51 feet) at which they occur excludes the possibility of meteoric origin; their occurrence in coal measures is suggestive of reduction. L. J. S.

Composition of Pre-Carboniferous Coals. By W. Hodgson Ellis (*Chem. News*, 1897, 76, 186—188).—In anthraxolite from five different localities, the percentage of ash ranged between 0·72 and 48·37, whilst the extreme variations in the percentage of the other constituents, calculated on the dry, and ash-free substance, were: carbon, 90·5 and 97·1; hydrogen, 0·5 and 6·2; oxygen, 1·6 and 5·5, which numbers support the view that anthraxolites result from the metamorphosis of bitumen. D. A. L.

Identity of Andorite, Sundtite, and Webnerite. By George T. Prior and Leonard J. Spencer (*Min. Mag.*, 1897, 11, 286—301; and *Zeits. Kryst. Min.*, 1898, 29).—Andorite was described in 1892 as an orthorhombic mineral from Felsöbánya, Hungary, having the composition $2PbS,Ag_2S,3Sb_2S_3$ (Abstr., 1895, ii, 21). Sundtite from Oruro, Bolivia, was shortly afterwards described as being orthorhombic, with the formula $(Ag_2,Cu_2,Fe)S,Sb_2S_5$ (Abstr., 1893, ii, 382). Webnerite, also from Oruro, was described as an argentiferous zinckenite with the composition $2\frac{1}{2}(PbS,Sb_2S_3) + Ag_2S,Sb_2S_3$ (Abstr., 1895, ii, 170). A new analysis of *measured crystals* from the original sundtite specimen gave the results under I, agreeing closely with the formula $2PbS,Ag_2S,3Sb_2S_3$, and thus showing, when considered in connection with the crystallographic measurements, the identity of sundtite with andorite. Measurement of a rough crystal from the original specimen of webnerite also proves the identity of this mineral with andorite. The results of the original analysis of webnerite agree just as closely with the more simple formula $2PbS,Ag_2S,3Sb_2S_3$ as with the formula given above, especially when the copper is taken as replacing silver.

	Pb.	Ag.	Cu.	Fe.	Sb.	S.	Total.	Sp. gr.
I.	24·10	10·94	0·68	0·30	41·31	22·06	99·39	5·377
II.	21·81	11·73	0·73	1·45	41·76	22·19	99·67	5·33

A description is also given of andorite "from Hungary," which occurs with quartz, pyrites, fluorite, chalybite, &c., in small crystals closely resembling freieslebenite in appearance; analysis of measured crystals gave the results under II. Alunite and cassiterite are described as being associated with Bolivian andorite.

The characters of andorite are summarised as follows: orthorhombic with $a : b : c = 0·6771 : 1 : 0·4458$; the number of observed crystal forms is 42. Colour, dark steel-grey, with brilliant, metallic lustre; opaque. Streak black and shining; powder dull. There is no cleavage, and the fracture is smooth and conchoidal; brittle. Sp. gr. = 5·35; $H = 3\frac{1}{4}$. Since there is no crystallographic relationship between andorite and the orthorhombic zinckenite (PbS,Sb_2S_3), and the monosymmetric miargyrite (Ag_2S,Sb_2S_3), it is pointed out that andorite must be a double salt, $2(PbS,Sb_2S_3) + Ag_2S,Sb_2S_3 = PbAgSb_3S_6$. L. J. S.

[Stannite from Bolivia.] By ALFRED W. STELZNER (*Zeit. deutsch. geol. Ges.*, 1897, **49**, 97, 131).—In a paper (pp. 51—142) on the silver-tin ores of Bolivia, it is pointed out that the mode of occurrence of cassiterite in Bolivia is quite different from that in other parts of the world, where it occurs in association with boron and fluorine minerals at granite contacts. In Bolivia, on the other hand, it occurs in ordinary mineral veins with sulphide ores, and is sometimes associated with stannite and other sulphostannates.

At Potosi, stannite occurs with pyrites, tetrahedrite, and mispickel in cubic crystals with tetrahedral development; the colour is steel-grey with a yellowish tinge, and the streak is black. Analysis by E. Ziessler of massive material, containing some blende and pyrites, gave, after deducting 6·96 per cent. of gangue,

S.	Cu.	Sn.	Fe.	Zn.	Ge.	Total.	Sp. gr.
29·00	29·00	27·50	13·75	0·75	nil	100·00	4·495

Heated in a closed tube, it decrepitates and gives off much sulphur in which it differs from ordinary stannite. L. J. S.

Distribution of Titanic Oxide upon the Earth. By FRANCIS P. DUNNINGTON (*Chem. News*, 1897, **76**, 221—222. Compare Abstr., 1892, 791).—Titanic oxide has been found in 34 samples of soil from various parts of the world and also in the borings from a deep well extending to a depth of 4490 ft. The quantity varied from 2·33 to 0·09 per cent. in the air-dried soil, the average being 0·515 per cent. when the exceptionally rich sample (from St. Helena) containing 2·33 per cent. is omitted. D. A. L.

Composition of Ilmenite. By SAMUEL L. PENFIELD and H. W. FOOTE (*Amer. J. Sci.*, 1897, [iv], **4**, 108—110; and *Zeit. Kryst. Min.*, 1897, **28**, 596—597).—The formula of ilmenite has been written as $(Fe,Mg)O,TiO_2$ and as $(Fe,Ti)_2O_3$. The mineral crystallises in the rhombohedral-tetartohedral division of the hexagonal system and the length of the vertical axis, 1·385, is not between those of hæmatite (1·359) and artificial titanium sesquioxide (1·316), neither of which show the tetartohedrism of ilmenite; this, together with the fact that the amount of Ti_2O_3 never exceeds that of Fe_2O_3, tells against the isomorphous mixture as given in the second formula. The presence of magnesia in many ilmenites can also not be accounted for by this formula. The largest amount of magnesia found in any ilmenite is shown in Rammelsberg's analysis of material from Warwick, New York, but as this has been suggested to be due to impurities, two new analyses have been made of a crystal from this locality; the mean is

SiO_2.	TiO_2.	FeO.	MgO.	MnO.	Fe_2O_3.	Total.	Sp. gr.
0·37	57·29	24·15	15·97	1·10	1·87	100·75	4·345

Here the ratio $RO_2:RO$ is very close to 1:1, thus indicating the existence of the molecule RO,TiO_2. Since $Fe_2O_3 + Ti_2O_3 = 2TiO_2 + 2FeO$, it cannot be told by chemical means whether all the titanium exists as TiO_2, but as MgO,TiO_2 is present it is best to assume that FeO,TiO_2 is also present, and not $(Fe,Ti)_2O_3$. In the published analyses of ilmenite, where $TiO_2:RO = 1:1$, there is often an excess of Fe_2O_3, and it is reasonable to suppose that the hæmatite molecule, Fe_2O_3 or $FeFeO_3$, is capable of mixing with the ilmenite molecules, $FeTiO_3$ and $MgTiO_3$, just as calcite and sodium nitrate are practically isomorphous. L. J. S.

Bixbyite a New Mineral. By SAMUEL L. PENFIELD and H. W. FOOTE (*Amer. J. Sci.*, 1897, [iv], **4**, 105—108; and *Zeit. Kryst. Min.*, 1897, **28**, 592).—Bixbyite was found by M. Bixby in cubic crystals implanted on topaz and decomposed garnet and rhyolite at about 35 miles south-west of Simpson, in Utah. The cubes are occasionally modified by the trapezohedron {211}. The colour is brilliant black with metallic lustre, and the streak is black. H = 6—6·5; sp. gr. = 4·945. The mineral fuses at about 4 and becomes magnetic. The fine powder is difficultly soluble in hydrochloric acid, and from the amount of chlorine evolved the available oxygen was calculated. The mean of two very close analyses is

SiO_2.	Al_2O_3.	Fe_2O_3.	TiO_2.	MnO.	MgO.	Available O.	Total.
1·21	2·53	47·98	1·70	42·05	0·10	4·38	99·95

The silica and alumina are due to the presence of topaz. Two forumlæ are possible, Fe_2O_3,Mn_2O_3 and FeO,MnO_2. If the mineral is an isomorphous mixture of Fe_2O_3, Mn_2O_3 and Ti_2O_3, as in the first formula, it would be expected to be rhombohedral and to belong to the hæmatite group. The second formula, which shows a relation to the cubic perofskite, (CaO,TiO_2), is the one adopted; small quantities of MgO and MnO replace FeO, and there is a little TiO_2 with the MnO_2. The mineral is therefore to be regarded as a ferrous salt of manganous acid, H_2MnO_3, corresponding with the manganese salt, braunite, $MnMnO_3$.

The associated topaz is crystallographically described; it is sometimes opaque owing to the enclosure of minute quartz crystals.

L. J. S.

Composition of Hamlinite. By SAMUEL L. PENFIELD (*Amer. J. Sci.*, 1897, [iv], **4**, 313—316; and *Zeit. Kryst. Min.*, 1897, **28**, 588. Compare Abstr., 1891, 20).—Hamlinite was described in 1890 as rhombohedral crystals occurring with herderite and bertrandite at Stoneham, Maine; only a few small crystals were found, so an analysis was not possible. The mineral has now been found with apatite, herderite, and bertrandite on felspar and muscovite in Oxford Co., Maine. The small crystals are rhombohedral or prismatic in habit; $rr' = 88^\circ 41'$. For the analysis, a whole specimen was powdered and the hamlinite separated by a heavy liquid, the accompanying apatite was then dissolved in dilute acid; the hamlinite so obtained, of sp. gr. 3·159—3·283, when examined under the microscope, appeared to be pure. The mean of four partial analyses is

P_2O_5.	Al_2O_3.	Fe_2O_3.	SrO.	BaO.	H_2O.	F.	SiO_2.	K_2O.	Na_2O.	Total (less) O for F.
28·92	32·30	0·90	18·43	4·00	12·00	1·93	0·96	0·34	0·40	99·37

Deducting silica, alkalis, &c., as felspar and mica, this agrees closely with the formula $Al_3Sr(OH)_7P_2O_7$, or $[Al(OH)_2]_3(SrOH)P_2O_7$, in which strontium and hydroxyl are partly replaced by barium and fluorine respectively. This is the first mineral pyrophosphate that has been described, neither has a phosphate of strontium or barium been before observed. The associated bertrandite is crystallographically described.

L. J. S.

Monazite from Idaho. By WALDEMAR LINDGREN (*Amer. J. Sci.*, 1897, [iv], **4**, 63—64).—The gravels and sands of the gold placers in the granite area of "Idaho Basin" contain, in the heavy residues, ilmenite, zircon, garnet, and monazite; the monazite is present in considerable quantity as yellowish or brownish grains. The crude material, with about 70 per cent. of monazite, contains about 48 per cent. of cerium oxides, and 1·20 per cent. of thoria.

L. J. S.

Tripuhyite, a New Antimonate of Iron from Brazil. By EUGEN HUSSAK and GEORGE T. PRIOR (*Min. Mag.*, 1897, 11, 302—303).—This new mineral is found as dull, greenish-yellow fragments in association with lewisite (Abstr., 1895, ii, 508) and derbylite (Abstr., 1897, ii, 410) in the cinnabar-bearing gravels at Tripuhy, Minas Geraes. Thin sections show an aggregate of translucent, highly refractive, and strongly doubly-refracting grains, which are biaxial and of a bright canary-yellow colour. A few minute flakes, probably of muscovite, is the only impurity present. The streak is canary-yellow. When heated, the mineral is infusible, and gives off antimony fumes, leaving a residue of ferric oxide. It is insoluble in hydrochloric and nitric acids. Sp. gr. 5·82. Analysis gave

Sb_2O_5.	FeO.	CaO.	SiO_2.	Al_2O_3.	TiO_2.	Undet. (alkalis ?).	Total.
66·68	27·70	0·82	1·35	1·40	0·86	(1·19)	100·00

Assuming the iron to be ferrous, this agrees with the formula $2FeO,Sb_2O_5$. L. J. S.

Blödite from the Punjab Salt Range. By FREDERICK R. MALLET (*Min. Mag.*, 1897, 11, 311—317).—Good crystals of blödite occur in the salt beds at the Mayo mines and at the Varcha mine; in external form and optical characters, they agree closely with the Stassfurt mineral. The crystals are colourless and usually transparent, but are sometimes clouded by fluid inclusions. The mean of two analyses is

MgO.	Na_2O.	SO_3.	H_2O.	NaCl.	Total.
11·97	18·53	47·82	21·54	0·07	99·93

This agrees closely with the usual formula, $MgSO_4,Na_2SO_4 + 4H_2O$. Between 85° and 120°, it loses $2H_2O$, and the remainder begins to go off at about 125°. Blödite has probably been formed by the interaction of magnesium sulphate (kieserite) with rock salt. L. J. S.

[Cupro-scheelite from New South Wales.] By GEORGE W. CARD (*Records Geol. Survey N.S.W.*, 1897, 5, 122).—Cupro-scheelite occurs, associated with bornite and copper carbonates, at Upper Timby, near Yeoval. It is usually of a greenish tint, but is sometimes white, and has a waxy appearance; rectangular outlines can be distinguished. Analysis gave

WO_3.	MoO_3.	CaO.	MgO.	Fe_2O_3.	Al_2O_3.	CuO.	CO_2.	H_2O.	Gangue.	Total.
57·73	trace	14·40	0·22	2·98	trace	7·08	1·56	2·55	13·04	99·56

Deducting gangue, this corresponds with WO_3, 66·7; CuO, 8·18 per cent. Stolzite from Broken Hill is also described. L. J. S.

Apophyllite from South Africa. By J. A. LEO HENDERSON (*Min. Mag.*, 1897, 11, 318—322).—In the so-called "blue-ground" of the farm Koppiesfontein near Jagersfontein, Orange Free State, apophyllite occurs as embedded octahedral crystals showing only the form $p\{111\}$. The crystals are almost colourless or feebly yellow; sp. gr. 2·371. Cleavage flakes show in polarised light a division into four sectors with biaxial characters. Analysis by Röhrig gave the results under I. No fluorine is given off when the mineral is treated directly with sulphuric acid, but it may be obtained from the ammonia precipitate of the hydrochloric acid solution of the mineral (compare Abstr., 1896, ii, 369).

	SiO_2.	Al_2O_3.	Fe_2O_3.	FeO.	CaO.	MgO.	K_2O.	Na_2O.	H_2O.	F.	NH_3.	Total.
I.	51·16	1·60		—	25·44	0·29	3·35	0·43	16·73	1·04	0·11	100·15
II.	34–35	15·44	3·55	14·80	10–11	7·16	—	—	11·34	—	—	—

The occurrence of apophyllite as embedded crystals is somewhat unusual; the matrix is a soft, talcose, serpentine-like mass, which gave the results under II; it is compared with the Kimberley "blue-ground." L. J. S.

Pseudomorphs from Northern New York. By CHARLES HENRY SMYTH, JUNR. (*Amer. J. Sci.*, 1897, [iv], 4, 309—312).—Pseudomorphs of pyroxene after wollastonite occur at Diana, Lewis Co.; here there has been an addition of magnesia. The crystals of scapolite and pyroxene in the limestone of Gouverneur, St. Lawrence Co., are sometimes altered to aggregates of a brown mica, probably phlogopite. Cases are cited in which garnet and epidote are apparently the alteration products of scapolite. L. J. S.

Serpentines of Davos. By JOHN BALL (*Inaug. Diss. Zürich*, 1897, 47 pp.).—As shown by its mode of occurrence and by the results of contact-metamorphism, the serpentine of Davos in Switzerland has been derived from a lherzolite which was intruded into the surrounding gneisses, dolomites, and schists. In the least altered rock (anal. I), olivine, enstatite and diallage are present, together with picotite, accessory rutile, and rarely hornblende. The most altered rock from the margins of the mass gave analysis II. White steatite (anal. III) occurs in lenticular patches and veinlets in the schists near the serpentine. Ophicalcite from the calcareous schists at the serpentine contact gave IV; it consists of fragments of altered serpentine with secondary hornblende in a calcite matrix.

	SiO_2.	Al_2O_3.	Cr_2O_3.	Fe_2O_3.	FeO.	CaO.	MgO.	H_2O.	CO_2.	Total.	Sp. gr.
I.	41·83	5·46	0·45	1·13	2·73	2·26	34·64	10·54	—	99·04	2·78
II.	39·95	1·86	0·23	3·37	3·57	—	35·63	13·87	—	98·48	2·61
III.	63·96	—	—	—	2·03	—	29·51	5·34	—	100·84	—
IV.	32·96	3·15	—	3·26	1·90	12·76	28·71	8·26	8·69	99·69	2·73

The associated rocks are described in detail; these are schistose whilst the serpentines are shattered. L. J. S.

[Leucite Rocks in Wyoming.] By WHITMAN CROSS (*Amer. J. Sci.*, 1897, [iv], 4, 115—141).—It was in the Leucite Hills, in south-western Wyoming, that leucite was first discovered in America, in 1871; here there is a lava flow of leucite rock, of which two new types are distinguished and named wyomingite and ordenite.

Wyomingite is a compact, reddish-grey rock with a marked schistose structure owing to the parallel arrangement of small, reddish flakes of mica, this being the only mineral visible in hard specimens. Under the microscope, it is seen to consist of phlogopite flakes in a ground-mass of small leucite crystals and diopside microlites; apatite, biotite, and residual glass are also present in small amount. From analysis I, the mineralogical composition is calculated as

Free silica.	Leucite.	Noselite.	Diopside.	Phlogopite.	Accessories.
18·7	26·1	8·7	18·8	19·9	7·8

The presence of so large an excess of silica is difficult to explain, since there is no quartz, &c., to be seen in the thin sections.

Ordenite (anal. II) has, with the exception of a vesicular structure the same outward appearance as wyomingite; here leucite and sanidine predominate as compared with phlogopite, diopside, and a peculiar amphibole; apatite and biotite are also present in small amount.

Madupite (anal. III) is the name given to a rock, probably a lava, from Pilot Butte, 15 miles east of the Leucite Hills; it is a dull, felsitic-looking rock with numerous reddish specks of phlogopite. Under the microscope are seen diopside, phlogopite, and probably perofskite in a brownish, glassy base. As calculated from the analysis, this base has the composition of leucite.

Phlogopite from wyomingite gave analysis IV, and V is of diopside from wyomingite and madupite. The rock analyses (I—III) by W. F. Hillebrand are interesting, on account of the large number of determined constituents. In connection with these rocks, the classification of leucite rocks is discussed.

	SiO_2.	TiO_2.	ZrO_2.	Al_2O_3.	$(Ce,Di)_2O_3$.	Cr_2O_3.	Fe_2O_3.	FeO.	MnO.	CaO.	SrO.	BaO.
I.	50·23	2·27	—	11·22	0·03	0·10	3·34	1·84	0·05	5·99	0·24	1·23
II.	54·17	2·67	0·22	10·16	—	0·05	3·34	0·65	0·06	4·19	0·18	0·59
III.	42·65	1·64	—	9·14	0·11	0·07	5·13	1·07	0·12	12·36	0·33	0·89
IV.	42·56	2·09	—	12·18	—	0·73	2·73	0·90	—	0·20	—	1·00
V.	50·86	3·03*	—	nil	—	—	1·19	1·82	0·03	23·32	—	—

	MgO.	K_2O.	Na_2O.	Li_2O.	H_2O (at 110°)	H_2O (above 110°).	P_2O_5.	SO_3.	Cl.	F.	CO_2.	Total (less O for F).	Sp.gr.
I.	7·09	9·81	1·37	trace	0·93	1·72	1·89	0·74	0·03	0·50	—	100·40	2·779
II.	6·62	11·91	1·21	,,	0·52	1·01	1·59	0·16	0·06	0·36	0·49	100·04	2·699
III.	10·89	7·99	0·90	,,	2·04	2·18	1·52	0·58	0·03	0·47	—	99·91	2·857
IV.	22·40	10·70	0·44	,,	2·35		0·06	—	—	2·46	—	99·77	—
V.	17·42	0·42	0·76	—	0·31		—	—	—	—	—	99·16	3·290

* $TiO_2 + P_2O_5$. II contains a trace of nickel.

Nitre (anal. VI, by L. G. Eakins) and nitratine (anal. VII) occur as crusts in exposed cavities in these rocks. These minerals are possibly of volcanic origin, as is sal ammoniac at Vesuvius.

	K_2O.	Na_2O.	N_2O_5 [calcd.].	CaO.	SO_3.	H_2O.	NaCl.	Total.
VI.	44·91	—	[51·49]	1·09	1·59	0·63	0·16	99·87
VII.	4·97	32·09	[61·58]	0·24	0·33	0·68	trace	99·89

L. J. S.

Mineral Water from Buda. By Ludwig Ilosvay de Nagy Ilosva (*Földtani Közlöny*, 1896, **26**, 293—300).—Water from the Mathias Hunyady spring, No. III, near Buda, in Hungary, gave the following results on analysis. It is colourless, and has a slight alkaline reaction and a bitter taste. Sp. gr. 1·03295 at 20°. In parts per 1000: SiO_2, 0·0109; Fe_2O_3,Al_2O_3, traces; Mg, 3·0033; Na, 5·3993; K, 0·3511; Ca, 0·4136; SO_4, 22·3805; Cl, 1·3119; HCO_3, 0·6846 = 33·5552; free CO_2, 0·0335. This is compared with other bitter waters from the neighbourhood of Buda; those nearer the town contain more chlorine.

L. J. S.

Physiological Chemistry.

Length of Time during which Food remains in the Digestive Apparatus of Rabbits. By HUGO WEISKE (*Landw. Versuchs-Stat.*, 1897, **48**, 375—379).—Six rabbits of the same litter, about four months old, received, for 12 days, 60 grams of air-dried oats; they were then fed on hay *ad libitum*, killed at different intervals, and the contents of their stomachs examined. The first was killed 3 hours after feeding with hay commenced, the second 6 hours, the third, fourth, fifth and sixth, 9, 12, 24 and 48 hours respectively after the commencement of hay feeding. The results showed that, under the conditions of the experiment, the grain was sufficiently digested in about two days to enable the excrement to be collected for the purpose of feeding experiments on the utilisation of foods. N. H. J. M.

Effect of Increasing Amounts of Fat in Food on the Utilisation of the Food Constituents. By A. WICKE and HUGO WEISKE *Landw. Versuchs-Stat.*, 1897, **48**, 390—400).—Two sheep were fed for 24 days as follows. No. 1 received during the whole period 1 kilogram of hay and 0·25 kilogram of linseed cake per day, whilst No. 2 received 0·75 and 0·2 kilogram of hay and cake respectively. For the first week no other food was given, but during the second, third, and fourth periods of the experiment, No. 1 had 60, 120, and 180 grams of olive oil, and No. 2, 50, 100, and 150 grams of olive oil per day. The results are given in tables showing the amounts of dry matter, proteid, fat, crude fibre, &c., in the food and in the fæces, and the amounts (actual and per cent.) digested.

Even in the fourth period, when the amount of oil given was very large, the oil was mostly digested and resorbed; and the digestibility of the fat of the food, and also, but to a less extent, the dry matter of the food, was increased. The digestibility of the proteids remained about the same, whilst the digestibility of the crude fibre was increased, and that of the nitrogen-free extract substances diminished, under the influence of oil. On the whole, however, the results showed that large amounts of oil have no great effect on the digestibility and resorption of food constituents. N. H. J. M.

Chemistry of Vegetable Physiology and Agriculture.

Alcoholic Fermentation without Yeast Cells. By EDUARD BUCHNER and RUDOLF RAPP (*Ber.*, 1897, **30**, 2668—2678. Compare Abstr., 1897, ii, 380).—The authors are convinced that the yeast extract described in previous papers does not owe its fermentative properties to micro-organisms, because passage through a Chamberland filter, which arrests bacteria, does not impair its activity. Moreover, it is found that a specimen of the extract, which time has rendered powerless to ferment, acquires but feeble activity when treated with 1 gram of living yeast, and becomes quite inactive if potassium arsenite is also added, whereas a freshly prepared extract rapidly induces fermentation. If the fermentative capacity of the yeast extract is due to microorganisms, it would be expected that the activity of the liquid would increase with lapse of time, owing to the reproduction of the agents; very rapid deterioration occurs, however, when the extract is kept for 2 days, when it loses the fermentative property. Zymase is not produced by quiescent yeast; a specimen of fresh yeast which yields an active extract when submitted at once to pressure, gives rise to an inactive liquid if pressed after an interval of 3 days. This circumstance probably affords an explanation of the previously observed fact that specimens of yeast from some breweries failed to yield an extract containing zymase.

The paper contains a description of the method by which the yeast extract is most conveniently obtained, and further observations have been made regarding the nature of its active enzyme, zymase. Its behaviour towards hydrocyanic acid resembles that of other enzymes, this agent checking the fermentative activity of zymase, and also destroying the power of the original yeast extract to cause effervescence when mixed with hydrogen peroxide.

Applying Meissl's method of determining the fermentative power of yeast, the authors have studied the fermentative power of yeast extract under various conditions; tables have been compiled which embody the results of their experiments on the influence of temperature, antiseptics, time, and the concentration of the sugar solution employed. Yeast extracts from different sources have been also compared.

M. O. F.

Oxidising Ferments (Oxydases). By Gabriel Bertrand (*Ann. Agron.*, 1897, **23**, 285—399. Compare Abstr., 1896, i, 534; ii, 61 and 571; 1897, ii, 117, 338, 493; this vol., i, 53).—It was previously observed that the ash of laccase contains manganese. It is now shown that the activity of the laccase varies with the amount of manganese present. Three samples (each 0·2 gram) which, in presence of 50 c.c. of 2 per cent. quinol solution, absorbed in 1½ hours 19·1, 15·5, and 10·6 c.c. of oxygen, contained respectively 0·159, 0·126, and 0·098 per cent. of manganese.

It was not found possible to remove the manganese from preparations of laccase, but by altering the mode of preparation the author was able to obtain a sample almost free from manganese. This sample, with quinol, absorbed only about 0·3 c.c. of oxygen, whilst the addition of manganese sulphate (Mn = 0·001 gram) induced an absorption of 4·3 c.c. of oxygen. Other sulphates (iron, aluminium, cerium, zinc, copper, calcium, magnesium, and potassium) had no effect.

Direct experiments with a number of manganese salts showed that they all had the property of fixing free oxygen in presence of quinol, although in very different degrees. Solutions were prepared containing quinol 1 per cent., and manganese 0·1 per cent. The solutions (100 c.c.) contained in 250 c.c. flasks were kept in agitation for a time, and the amount of oxygen absorbed ascertained. The following numbers show the amounts of gas absorbed by each salt :

Nitrate.	Sulphate.	Chloride.	Formate.	Benzoate.
1·5	1·6	1·8	7·4	15·3
Acetate.	Salicylate.	Lactate.	Gluconate.	Succinate.
15·7	16·3	17·6	21·6	22·1

In some cases, a crystalline precipitate (quinhydrone) separated : with the gluconate in 2 hours, but much later with the salicylate.

N. H. J. M.

Vegetation with and without Argon. By Th. Schloesing, jun. (*Compt. rend.*, 1897, **125**, 719—722).—Oats and feather-grass (*Houque laineuse*) respectively were grown in confined volumes of ordinary air and air deprived of argon, the ratio CO_2/O_2 being determined in each case, and the general appearance, behaviour, &c., of the plants observed. The conclusion drawn from the experiment is that argon has no appreciable influence on vegetation. C. H. B.

Researches on Germination. By F. Victor Jodin (*Ann. Agron.*, 1897, **23**, 433—471. Compare Giglioli, Abstr., 1897, ii, 423).—Peas, kept under ordinary conditions, retain from 0·1 to 0·3 gram of water per gram of dry matter, an amount which is sufficient to determine gradual changes which finally result in loss of germinating power.

Peas (3·452 grams) kept in air over mercury and exposed to light, in 4½ years absorbed 2·4 c.c. of oxygen, and produced 1·8 c.c. of carbonic anhydride ; the peas no longer germinated. In absence of light, there was no action during the same period, and the seeds germinated normally. Of nine peas which were kept immersed in mercury for over 10 years, two germinated almost normally ; two others germinated, but not satisfactorily, whilst the remaining five failed to germinate completely.

A number of peas, weighing 3·694 grams, were kept in air saturated with water at 20—23°. In 10 days, the weight of the seeds increased to 5·602 grams, but there was no germination. Thirteen days later, the weight increased to 6·143 grams, and 15 peas germinated, whilst six did not. No more of the peas germinated, and the weight, 37 days after the commencement of the experiment, was 5·650 grams. The results show that the minimum of hydration at which germination takes place is about 0·9 per grain of seed.

In the next experiments, sterilised peas were kept under glass shades closed with mercury, and the composition of the air ascertained from time to time. A few c.c. of sterilised water was present, to enable germination to take place. Similar experiments were made with peas with insufficient moisture for germination (hydration = 0·331 to 0·737). The results (which are given in detail in tables) show that the peas which could not germinate, owing to the amount of water present being insufficient, showed a respiratory activity, apparently similar to, and sometimes exceeding, that of the peas which germinated.

With regard to the effect of an excess of carbonic anhydride on germination, peas and cress did not germinate when kept in an atmosphere of $CO_2 = 58·3$, $O_2 = 26·6$, and $N_2 = 15·1$ per cent. After being 17 days in this atmosphere, all the peas were killed, but most of the cress germinated when surrounded with ordinary air. Peas, however germinate in presence of 7 per cent. of carbonic anhydride, and produced, in 13 per cent. of the gas, rootlets 2—3 mm. long; in presence of 50 per cent. of carbonic anhydride, peas rapidly lose the power of germinating, although they absorb oxygen and give off carbonic anhydride.

The first stages of germination, resulting in the production of a rootlet 2—3 times the diameter of the pea, can take place without the intervention of an appreciable amount of oxygen. Subsequently, oxygen is necessary; the oxygen must be in the uncombined state, and is not available either in the form of nitrates or of hydrogen peroxide. The reduction of nitrates, during germination, observed by Boussingault was, no doubt, due to the action of microbes (*Agronomie*, 7, 130. Compare also Godlewski, Abstr., 1897, ii, 583). N. H. J. M.

Influence of Arsenic on Germination. By BENGT JÖNSSON (*Ann. Agron.*, 1897, **23**, 491; from *Konigl. Landt. Akad. Handl.*, 1896, **35**, 95).—Lyttkens considers that the arsenic present in superphosphates may sometimes explain the bad effects occasionally observed. Arsenic acid is injurious to germination, and arsenious acid is much more injurious than arsenic acid. The author's experiments gave discordant results. In some cases arsenic acid was favourable to germination, but this is attributed to its destructive action on the microbes present on the surface of the seeds. N. H. J. M.

Mean Molecular Weight of the Soluble Matter in Germinating Grain. By LEON MAQUENNE (*Compt. rend.*, 1897, **125**, 576—579).—The grain was allowed to germinate in presence of distilled water for a definite time, and was then crushed and pressed, the freezing point of the liquid and the quantity of dissolved solid matter in it being determined either with or without previous dilution with water as the case might require. From the data thus obtained, the mean molecular weight of the dissolved matter was calculated. In the case of rye, after germinating eight days, it was 445; after twelve days, 203; and after thirty days, 167: in the case of peas, after eight days, 306; after fifteen days, 199, and after forty days, 112: in the case of white lupin, after fifteen days, 239; after twenty-two days, 226; and after forty days, 137. Although the molecular weights differ widely in the case of different plants, it is clear that, for the same species, the mean molecular weight of the soluble matters diminishes as germination proceeds. It would follow that the transformation of the reserve matter in the seed does not consist, as is generally supposed, simply of a conversion of amylaceous substances into sugars, and of proteids into simple amides. Glucose and asparagine are probably the ultimate terms of the transformation, but their formation is preceded by that of soluble intermediate products. In the cases of peas and lupins, for example, no glucose can be detected in the soluble products after eight days germination.

Similar determinations of the mean molecular weight of dissolved substances in the juice of different parts of green wheat soon after flowering gave the following results. Near the root, 176; middle of plant, 194; near the ear, 215. The molecular weight of the soluble matter therefore increases as it ascends the plant, and gradually approaches the point where it will ultimately be stored up in the seed, Experiments showed that the osmotic pressure was practically the same in all parts of the plant. C. H. B.

Substitution of Arsenic Acid for Phosphoric Acid in the Nutrition of Plants. By JULIUS STOKLASA (*Ann. Agron.*, 1897, **23**, 471—477).—Oats were grown in nutritive solutions (1), without phosphorus or arsenic, (2), with phosphoric acid (0·00142 per cent.) and arsenic acid (as sodium salt, 0·0023 per cent.), (3), with phosphoric acid (0·0142 per cent.), and (4), with arsenic acid (0·0023 per cent.) but without phosphoric acid. The following results were obtained:

	Average length		Dry produce					
	roots. cm.	stems. cm.	roots. grams.	stems, &c. grams.	seeds. grams.	Number of seeds.	Lecithin in leaves. per cent.	Furfuraldehyde in leaves. per cent.
1.	9·3	36·2	0·63	2·96	—	—	0·38	8·11
2.	33·2	95·4	4·6	13·65	6·85	347	1·46	8·43
3.	35·6	96·7	4·8	14·38	7·32	368	1·35	8·09
4.	18·5	49·3	1·02	4·84	—	—	0·41	10·27

The plants of series 4 (with arsenic) developed better than those of series 1, but the flowers soon dried up and the leaves were bluish-green. In presence of phosphoric acid, arsenic acid had no injurious effect.

It was previously shown that chlorophyll formation (and consequently assimilation of carbon) depends on the presence of lecithin, a compound containing phosphorus, produced by the interaction of glycerophosphoric acid, choline, and chlorophyllanic acid. In these experiments, the leaves produced under the influence of arsenic acid contained only about the same amount of lecithin as in series 1. On further examining the leaves, it was found that those of series 1, 2, and 3 contained chlorophyll grains, often accompanied with starch, whilst those of series 4 contained chlorophyll grains but no starch. In absence of phosphorus and arsenic, the leaves were yellow. Furfuroids were produced in largest quantity under the influence of arsenic acid alone (they were determined as furfuraldehyde. See table). In favouring the formation of furfuroids, arsenic acid increases the development of assimilating organs.

Whilst 0·02 per cent. of arsenic acid is injurious to vegetation, as little as 0·0002 per cent. of arsenious acid is sufficient to destroy plants. N. H. J. M.

Transformation of Sugars into Oil in the Olive. By C. GERBER (*Compt. rend.*, 1897, **125**, 658—661).—The respiratory quotient CO_2/O_2 for olives is less than unity when they are young, and when, as Luca has shown (*Compt. rend.*, 1861 and 1862), they contain a high proportion of mannitol and a very low proportion of oil. It becomes greater than unity when they are large and when they change to violet-red, and at this period Luca found that the proportion of mannitol diminishes, whilst that of oil increases. Since the olives contain neither citric, tartaric, nor malic acid, and no alcoholic fermentation goes on in the fruit, it follows that the excess of the respiration quotient above unity indicates that the oil is being formed at the expense of the mannitol. C. H. B.

Quantity of Pentosans and other Carbohydrates in Peat. By H. von Feilitzen and Bernhard Tollens (*Ber.*, 1897, **30**, 2571—2576).—The formation of furfuraldehyde from vegetable matter on distillation with hydrochloric acid cannot be taken as a certain indication of the presence of pentosans, since other substances such as glycuronic acid, &c., yield it under the same conditions.

The quantity of pentosans present in the peat was determined by the Krüger-Tollens method, the largest quantity being found in the upper layers, and decreasing with the depth, the amount being roughly inversely proportional to the carbon present. The quantity of cellulose also decreases with the depth, the amount present in a sample of *Sphagnum cuspidatum* at the surface being 21·11 per cent., at 20—100 cm. deep, – 15·20 per cent., and at 100—200 cm. deep, – 6·87 per cent.

On hydrolysing the peat, mannose, galactose, levulose, and pentoses were detected in the product. J. F. T.

Fermentation of Peat. By H. von Feilitzen and Bernhard Tollens (*Ber.*, 1897, **30**, 2577—2581).—Experiments were carried out with the object of obtaining alcohol from peat by hydrolysing with sulphuric acid and fermenting the glucoses thus formed with yeast. The following table shows the results obtained.

	Sugar before fermentation.	Pentoses.	Fermentable.	Alcohol theory.	Alcohol found.
Speckener Moor I. (20—100 cm.)......	27·87	14·49	13·38	6·84	6·79
II. (100—200 cm.) ...	22·71	11·08	11·63	5·94	5·46
III. (200—300 cm.) ...	11·22	6·67	4·55	2·33	1·48

The upper, least decomposed, peat layers yield, therefore, more alcohol than the lower dark coloured layers rich in carbon. J. F. T.

Composition of Oats. By Balland (*Compt. rend.*, 1897, **125**, 579—581. Compare Abstr., 1896, ii, 64).—There is no relation between the mean weight of the grains, the weight of grains per hectolitre, and the colour of the oats, nor between these factors and the proportion of cellulose, fat, and inorganic matter in the oats. As a rule, however, in the case of Russian oats, the white contain a higher proportion of nitrogen than the black. There are also no definite relations between the weights of the ash (inorganic matter), cellulose, fat, and nitrogen, except that in the same species a maximum of cellulose always coincides with a reduced proportion of nitrogen. There are no general relations between the weight of the kernel or of the husk and the mean weight of the grains or the weight of grain per hectolitre; white oats often give less kernel than black oats, but the contrary is the case with Russian oats. The ratio of kernel to husk varies greatly in different localities; in hot climates, the proportion of husk is always high, although its composition is the same as in temperate climates, whereas the proportion of nitrogen in the kernel is much higher in hot climates than in temperate. Algerian oats contain as much or more nitrogen than the best oats from some European localities, although they contain a considerably higher proportion of husk. For oats of the same species, the nutritive value increases with the weight of the kernel. The composition of an alcoholic extract of oats varies greatly with the concentration of the alcohol; with absolute alcohol, fats only and no nitrogenous matters are dissolved, but with more and more dilute alcohol the proportion of nitrogenous matter dissolved increases. No alkaloid is present, and the irritant properties observed by Sanson (Abstr., 1884, 914) are probably due to an essential oil present in small proportion. The high proportion of fat in oats, combined with the proportion of nitrogenous matter and phosphates, makes them a more complete food for men and animals than either wheat, barley, or rye.

Whole oats can be kept for several years without any appreciable change in their composition, but when they are crushed changes take place, the acidity rises rapidly, and the fats undergo alteration. The composition of oats varies greatly according to latitude and climate; even with the same species in the same district the composition varies with the season. Analyses of a thousand varieties of oats grown or imported into France in the years 1893—1897 show that the variations are of the following order:—Water, 9·80 to 17·00; nitrogenous matter, 7·10 to 14·13; fats, 2·89 to 6·82; sugars and starches, 56·95 to 64·32; cellulose, 7·02 to 12·24; ash, 1·88 to 6·90 per cent. Weight of the kernel, 61·00 to 79·50; and weight of the husk, 20·50 to 39·00 per cent. Mean weight of 100 grains, 1·80 to 4·32 grams. C. H. B.

Composition of the Seeds and Etiolated Seedlings of Lupinus angustifolius, L. By M. MERLIS (*Landw. Versuchs-Stat.*, 1897, **48**, 419—454).—The following summary shows the amounts of the different constituents, (1), in 100 parts of the dry seeds freed from husks; (2) in the corresponding amount (72·212 parts) of dry etiolated plants, 15 days old; and (3) the loss or gain.

	N.	Proteids.	Nuclein, &c.	Lupeose.	Glycerides.	Lecithin.	Cholesterol.	Cellulose.	Insol. N-free extract.	Asparagine.
1.	6·61	36·18	0·88	11·34	7·48	2·20	0·20	1·58	27·89	0
2.	6·56	7·63	1·53	0	1·62	1·14	0·46	8·44	11·77	18·17
3.	−0·05	−28·55	+0·65	−11·34	−5·86	−1·06	+0·26	+6·86	−16·12	+18·17

Under nuclein, &c., indigestible nitrogenous substances are included, and under glycerides, free fatty acids. The amounts of ash were (1) 3·51, (2) 3·83, and (3) +0·32 parts. The seeds contained, besides the above, 0·31 per cent. of alkaloids.

The etiolated seedlings were found to contain leucine, amidovaleric acid, and choline. Arginine was not present unless in traces. Phenyl-α-amidopropionic acid was probably present in very small amounts.

The results show, in the first place, that the total nitrogen of the seeds and of the seedlings is practically the same, and that germination is not accompanied with loss of nitrogen. The proteids break up, yielding asparagine, amido-acids, and bases. The carbohydrates of the seeds diminished considerably, the lupeose (β-galactan) disappearing completely after 8—9 days, whilst there was a great increase of cellulose. The increase in ash may be due to the action of water on the glass, or to the production of sulphates in the breaking up of the proteids.

In order to ascertain to what extent the constituents of the cotyledons are utilised during the development of seedlings, the amounts of the different seeds freed from husks were compared with the amounts in the cotyledons of seedlings 2½ weeks old. The following are the amounts (in grams) in (1) 1000 seeds (dry matter = 102·0 grams), and (2) 2000 cotyledons (dry matter = 21·59 grams).

	N.	Proteids.	Crude fat.	Lecithin.	Cellulose.	Insol. N-free extract.	Ash.
1.	6·64	37·14	7·04	2.26	1·77	28·17	3·36
2.	1·67	1·92	0·94	0·25	2·01	3·54	1·19

The results show that the reserve proteids, the fat and lecithin, are almost entirely consumed in 2½ weeks, whilst most of the nitrogen-free extract also disappeared.

With regard to the decomposition of proteids during the growth of etiolated seedlings, the nitrogen in different forms was determined at intervals of three days. The following results show the amounts in 100 parts of dry seeds and in the corresponding amounts of seedlings at the different dates.

	Dry matter.	Nitrogen. As proteids.	As asparagine.	In phosphotungstic acid precipitate.	In difference.
Seeds	100	6·14	—	0·42	—
Seedlings, 3 days	96·08	5·56	0·49	0·45	0·11
,, 6 ,,	89·20	3·19	1·93	0·49	1·00
,, 9 ,,	82·73	2·38	3·19	—	—
,, 12 ,,	75·80	1·93	3·75	—	—
,, 15 ,,	72·72	1·49	3·85	0·45	0·82
,, 18 ,,	70·69	1·51	4·23	0·43	0·34

The rapid decomposition of proteids in the early period of growth is in accordance with the observations of Prianischnikoff (Abstr., 1895, ii, 124; compare E. Schulze, *Vierteljahrschr. naturforsch. Ges. Zürich*, 1894, 264). The increase of asparagine in the last period, when there was no corresponding decrease of proteids, would seem to indicate a transformation into asparagine of other products of the decomposition of proteids. This would lend support to the view that asparagine is not a primary product from proteids. N. H. J. M.

Losses and Chemical Changes in Vegetable Foods when kept for a long time at High Temperatures. By HUGO WEISKE (*Landw. Versuchs-Stat.*, 1897, 48, 379—389).—A number of glass jars were filled with hay and heated in a water oven. Half of the jars were left open, whilst the other half were closed after moistening the contents with distilled water. The hay was analysed in its original condition, and at intervals of a month, for 6 months. The dry hay gradually became light brown, whilst the moistened hay soon acquired a dark brown colour. There was a progressive loss of dry substance in both cases, but much more with the damp than with the dry hay. The amounts of ether extract and of crude fibre diminished, whilst the proteids, and especially the non-nitrogenous extract, increased.

There was, however, a very great decrease of digestible proteids; whilst the original hay contained 1·21 per cent. of digestible, and 0·76 per cent. of indigestible, nitrogen, the dry hay contained, after 6 months heating, digestible, 0·46; indigestible 1·72 per cent., and the damp hay, digestible 0·25, indigestible 2·04 per cent. Heating for 4 days had practically no effect on the digestibility of the proteids.

N. H. J. M.

Action of Potassium Chloride on the Lime Resources of the Soil. By CHARLES A. GOESSMANN (*Hatch Exper. Stat. Mass. Agric. Coll. Bull.*, 38, 1896, 14—16).—Experimental plots which had for years received potassium chloride yielded crops of unhealthy appearance. After an application of slaked lime (500—600 lbs. per acre), the succeeding crop was healthy. Analyses of the drainage from each plot at the end of the season, showed the presence of a larger amount of lime in the case of plots which had received potash in the form of chloride, than where potassium sulphate had been applied.

It is concluded that when land containing limited amounts of lime is manured with potassium chloride, lime should be directly applied from time to time. It is safer to apply potassium chloride to deep soil with a free subsoil, than to a shallow soil with a compact clay subsoil. In the latter case, there is a possibility of an excessive accumulation of calcium and magnesium chlorides near the roots of the plants.

N. H. J. M.

Remarkable Observation on Ignited Basic Slag. By MAX SCHMOEGER (*Landw. Versuchs-Stat.*, 1897, 48, 413—418).—Basic slag (5 grams) was fused with precipitated silica (0·6 gram) and the phosphoric acid determined in the product, as well as in the original slag, and in the slag fused without silica. The following results were obtained:—

		P_2O_5.	
	SiO_2. per cent.	Total per cent.	Citrate-soluble per cent. of total.
Original slag	2·23	20·19	48·4
Fused with silica	12·07	17·80	83·5
Fused without silica	2·25	19·87	20·1

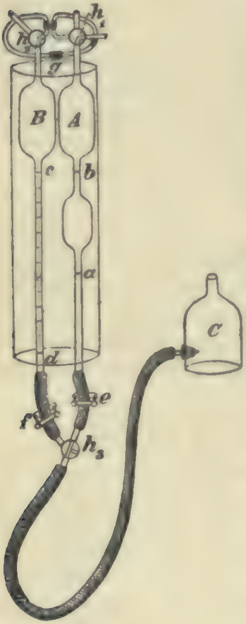
The fused samples were ground more finely than the original slag before analysis. Whilst fusion without silica resulted in a gain in weight (0·5 per cent.), when fused with silica the substance lost about 0·6 per cent. in weight owing to evolution of carbonic anhydride.

Two other samples of slag were ignited with and without silica. With silica, there was, as before, an increase in soluble phosphoric acid. Without silica, there was also a distinct increase, instead of a decrease, in soluble phosphoric acid, and there was a decrease instead of an increase in weight. (Compare G. Hoyermann, *Die Citratlöslichkeit d. Phosphorsäure in Thomasmehl.*)

N. H. J. M.

Analytical Chemistry.

Four New Methods of Measuring Gases. By OTTO BLEIER (*Ber.*, 1897, **30**, 2753—2759).—A new compensation method is first described, in which it is not the standard gas, but the gas under examination, that is kept constant in volume, or is adjusted to a known fraction of its original volume. The apparatus in the figure, which is designed for the analysis of ordinary air, is surrounded by a water-jacket. A is filled with the gas to be examined and holds 100 c.c. down to the mark *a*, 79·5 c.c. down to the mark *b*. B contains the standard volume of air; it holds 100 c.c. down to *c*, and the space between *c* and *d* contains 1 c.c. and is graduated in 0·01 c.c. Both vessels having been filled, to *a* and *c* respectively, at the atmospheric pressure, their upper extremities are connected by means of the capillary tube shown in the figure; there is a drop of liquid in the centre of this, which drop will remain in the centre if the two stop-cocks (h_1 and h_2) be opened. After absorption of the carbonic anhydride, the liquid is brought to its original levels (*a* and *c*) in A and B, and the two stop-cocks are opened. There is now a slightly diminished pressure in A, owing to the absorption that has taken place, and consequently the drop of liquid moves towards A; the liquid in *c*, *d* is lowered until the drop comes back to its original position. If the volume from *c* to the point to which it has been lowered is 0·15 c.c., then the percentage of carbonic anhydride is $0{\cdot}15 \times \frac{100}{100{\cdot}15}$. The oxygen is now absorbed, and the same process is again gone through, except that the liquid in A is brought to the level *b* instead of *a* ($ab = 20{\cdot}5$ c.c.). Supposing the final level in *cd* to be 0·53 c.c., then the percentage of oxygen is $20{\cdot}5 + 0{\cdot}53 \times \frac{79{\cdot}5}{100{\cdot}53}$. The advantage of this method is that the measurements are made with great accuracy, and, further, all under approximately the same pressure, so that the use of water is permissible. A special apparatus is required, however, for the analysis of any particular gas, as measurements can only be made in the neighbourhood of those percentages with which the fixed marks on A correspond.



The apparatus figured can also be used for compensation measurements in the ordinary way, the gas under examination being the one of which the volume is accurately measured. This gas is then contained in B which it fills to *d*, the volume down to this point being now 100 c.c.; A now contains the standard volume of air, and is filled only to *b* under atmospheric pressure. After absorption of carbonic anhydride, the percentage absorbed is measured by the rise in *d*, *c*, when the drop of liquid has been adjusted to its initial position in the capillary tube. In measuring the oxygen absorbed, the level in A must be brought to *a*. A combination of the two methods may also be adopted, both pipettes being graduated below; the second method is used first, as far as the apparatus allows, and then the first method.

An arrangement is next described which permits of measurements of volume by means of pressure readings. The pipette, which is enclosed in a water-jacket, consists of 5 bulbs, each approximately of 20 c.c., on the narrow connecting-tubes of which marks are placed, one between each pair of bulbs; the volume of the pipette down to each of these marks is accurately known. In connection with this measuring pipette, there is a movable reservoir and a graduated manometer tube which is clamped in position and extends about 60 cm. above and below the lowest mark of the pipette; at the same levels as this mark and those above it, marks are drawn on the manometer. The gas is first compressed to the lowest mark and the pressure noted in the manometer; after the absorption of one of the constituents, the pressure is again noted, the volume being adjusted to the same mark, or, if that is impossible, to one above it. This apparatus can be used with water.

Lastly, a measuring pipette with reserve spaces is described. This is enclosed in a water-jacket, and consists of two parallel vertical branches. One branch is a cylindrical tube, graduated, and holding 20 c.c. from the uppermost to the lowermost graduation; the other consists of 4 bulbs, with marks, one on the constriction below each bulb; the volume from the uppermost graduation on the other tube to these marks is known accurately, and is approximately 20, 40, 60, and 80 c.c. The two branches are joined in one piece at the top by a connecting tube to which the glass stop-cock for the admission of the gas is also fused; at their lower ends, the two branches are connected with a movable reservoir, by means of a three-way tube and india-rubber tubing. In measuring the gas, the liquid is first driven up to one of the marks (whichever is suitable), the india-rubber tubing below this is closed by a spring clip, and then the reservoir is adjusted so that the level of the liquid is the same in it as in the graduated branch of the pipette; the volume of the gas is then read off. C. F. B.

Separation and Estimation of Chlorine and Bromine in a Mixture of Alkali Salts. By Henri Baubigny and Paul Rivals (*Compt. rend.*, 1897, **125**, 607—610).—When estimating bromine by expelling it from solutions of bromides by the combined action of cupric sulphate and potassium permanganate (this vol., ii, 90), the concentration of the liquid is an important factor; if the solution is dilute, a relatively larger quantity of copper sulphate must be added in order to ensure complete liberation of the bromine. Provided that an excess of permanganate is present, the exact proportion of it has little influence on the accuracy of the result. Direct experiments show that chlorides are not decomposed under the conditions specified, provided the quantity in 100 c.c. of liquid containing 15 to 16 grams of crystallised copper sulphate and 0·7 to 0·8 gram of potassium permanganate is not equivalent to more than the 0·250 gram of sodium chloride; under these conditions, however, the whole of the bromine is liberated. The time required for complete elimination of the bromine is practically unaffected, within ordinary limits, by the proportion of bromide present, but the last traces of the bromine are somewhat difficult to expel. C. H. B.

Detection of Traces of Bromine by Means of Fluorescein. By HENRI BAUBIGNY (*Compt. rend.*, 1897, **125**, 654—657).—Paper prepared with a somewhat concentrated solution of fluorescein in acetic acid is placed in the mouth of the vessel, or in a tube leading from the vessel from which the gas or vapour supposed to contain bromine is issuing. The presence of even minute quantities of bromine is indicated by the appearance on the paper of pink streaks, due to the formation of eosin. The method is not applicable to mixtures of small quantities of free bromine with large quantities of free chlorine, but in the case of a mixture of chloride and bromide the bromine can be liberated by means of copper sulphate and potassium permanganate. C. H. B.

Estimation of Phosphorus in Steel, Iron, and Iron Ores. By JULIUS OHLY (*Chem. News*, 1897, **76**, 200—201).—Two grams of steel are dissolved by heating with 45 c.c. of nitric acid of sp. gr. = 1·16, 5 c.c. of saturated potassium permanganate solution is added, and the whole boiled until the pink colour disappears; five or six drops of saturated sugar solution is then dropped in to dissolve the precipitate, avoiding excess, and the whole cooled to 60°. It is then shaken with 5 c.c. of ammonia until clear, 30 to 40 c.c. of molybdate solution is added, the whole well shaken, filtered, washed six times, and the flask mixed with 2 per cent. nitric acid, then with 2 per cent. potassium nitrate. The filter and precipitate are returned to the flask, the precipitate dissolved in 25 c.c. of standardised sodium hydroxide, and three or four drops of phenolphthalein added to the solution, which is then titrated with nitric acid, standardised against steel having a known percentage of phosphorus.

The measurement of the bulk of the molybdate precipitate, and so indirectly of the phosphorus, in a Goez tube is also suggested.

D. A. L.

Estimation of Nitrogen in Guano. By V. SCHENKE (*Chem. Zeit.*, 1897, **21**, 490).—The author has proved by a series of analyses that the nitric nitrogen contained in guanos is best calculated from the difference between the total nitrogen and that obtained by Kjeldahl's process.

Haselhoff's water extraction method gives untrustworthy results, although better results may be obtained by using cold water (compare this vol., ii, 36). L. DE K.

Estimation of Phosphoric Acid as Phosphomolybdic Anhydride. By WOY (*Chem. Zeit.*, 1897, 441—443, 469—472).—The following reagents are required. A solution of 120 grams of ammonium molybdate in 4 litres of water; a solution of 340 grams of ammonium nitrate in 1 litre of water; nitric acid of 1·153 sp. gr.; a washing solution containing 200 grams of ammonium nitrate and 160 c.c. of the nitric acid (sp. gr. 1·153) in 4 litres.

The sample is dissolved in sulphuric acid, made up to a definite bulk, and an aliquot part, representing about 0·5 gram of material, is neutralised with ammonia and mixed with 10 or 20 c.c. of nitric acid; after adding 30 c.c. of the ammonium nitrate solution, the liquid is heated to boiling, and a slight excess of the molybdate solution is added, 5 c.c. of which is equivalent to about 1 per cent. of phosphoric acid in the sample. The precipitation is complete within 15 minutes, and the deposit is collected and washed with 50 c.c. of the hot washing solution To purify it, it is dissolved in 10 c.c. of an 8 per cent. solution of ammonia and then mixed with 20 c.c. of the ammonium nitrate, and also 1 c.c. of the molybdate solution. After heating to boiling, 20 c.c. of hot nitric acid is added to reprecipitate the compound. It is then collected in a Gooch's crucible, and after being washed with the acid ammonium nitrate, it is ignited at a dull red heat. The black residue contains exactly 3·946 per cent. of phosphoric anhydride. L. DE K.

Toxicological Detection of Arsenic. By E. FRICKE (*Chem. Zeit.*, 1897, 21, 303).—When using Marsh's test, it sometimes happens that very slight mirrors are obtained which, however, may consist of carbon. In order to positively say whether arsenic is absent, the author recommends the following process.

The decolorised solution is, as usual, treated with hydrogen sulphide, the precipitate which forms is dissolved in ammonium sulphide, the solution evaporated to dryness and the residue fused with sodium carbonate and nitrate; the melt is then dissolved in water, evaporated with sulphuric acid, and the residue dissolved in water and again treated with hydrogen sulphide. Owing to the complete absence of organic matter, any yellow coloration or precipitate points to the presence of arsenic, but if the liquid remains clear, arsenic is certainly absent. To ascertain whether the yellow precipitate is really arsenic it must be tested in the Marsh's apparatus. L. DE K.

Detection of Thioxyarsenic Acids. By LEROY W. MCCAY (*Chem. Zeit.*, 1897, 21, 487).—A dilute solution of sodium orthomonothioxyarseniate gives with strontium chloride a white, amorphous precipitate of the corresponding strontium salt which soon becomes crystalline, whilst if barium chloride is added to the dithioxy-salt of sodium, the corresponding barium salt is produced. In this way, the two arsenical compounds may be separated by first removing the mono-compound with strontium chloride and then precipitating the di-salt by barium chloride.

The mono-compound may also be utilised for separating calcium from barium. L. DE K.

Titration of Sodium Thiosulphate with Iodic Acid. By CLAUDE F. WALKER (*Amer. J. Sci.*, 1897, 4, 235—242).—Riegler has stated that sodium thiosulphate may be titrated by means of iodic acid, using starch as indicator; directly all the thiosulphate is converted into tetrathionate and iodide, the addition of more iodic acid liberates iodine and gives rise to a blue coloration. By a long series of experiments, the author has proved that the reaction between iodic acid and sodium thiosulphate is so indefinite in its nature and so influenced by time, dilution, and mass, that the method proposed by Riegler is quite impracticable. L. DE K.

Estimation of Carbon Bisulphide in Alcohol. Carbon Tetrachloride, &c. Purification of Carbon Tetrachloride and a New Compound of the same. By W. SCHMITZ-DUMONT (*Chem. Zeit.*, 1897, 21, 487—488, 510—511).—The usual process is to boil the spirit with potassium hydroxide dissolved in alcohol, the potassium xanthate thus produced being estimated in various ways. The author prefers oxidising it with potassium permanganate in an alkaline solution, and estimating the sulphuric acid thus produced.*

The results are, however, generally a trifle low; the following method is better: 10 c.c. of the sample is heated with 20 c.c. of alcoholic solution of lead acetate and 10 c.c. of normal alcoholic potash for 20 minutes at 50—60°; the lead sulphide formed is then collected, and the sulphur converted into sulphuric acid by means of nitric acid and bromine. Another process is given, based on the formation of silver sulphide; 10 c.c. of the sample is mixed with 50 c.c. of a 5 per cent. alcoholic solution of silver nitrate and 5 c.c. of aniline, and the whole is then heated for half an hour at 60°; the silver sulphide thus obtained is afterwards fused with sodium nitrate and carbonate, to convert the sulphur into sulphate.

Carbon tetrachloride may be freed from carbon bisulphide by dissolving a quantity of potassium hydroxide, more than sufficient to decompose the carbon bisulphide, in 100 c.c. of alcohol, and adding this to a litre of the chloride. After heating for half an hour at 60°, the xanthate is precipitated by adding water, and the liquid is repeatedly washed with water until free from alcohol. To free the tetrachloride from any trichloride, it is first dried over potassium hydroxide and then distilled over paraffin.

The author has found that, on prolonged contact, carbon tetrachloride and phenylhydrazine yield silky needles of the composition $(C_6H_5\cdot NH\cdot NH_2)_2HCl$. L. DE K.

[* NOTE BY ABSTRACTOR.—In reference to the oxidation of sulphur in an alkaline solution by means of permanganate, compare Abstr., 1895, ii, 184.]

Cyanide Titration of Copper. By HARRY BREARLEY (*Chem. News*, 1897, 76, 189—191).—To avoid the uncertainty connected with the ordinary method in which the discharge of colour is taken as the final stage, the author suggests running in cyanide until this stage is reached, then adding potassium iodide and titrating back to a permanent turbidity with silver nitrate. He finds in this case also (compare Davies, *Chem. News*, 1888, 58, 131) that the use of sodium carbonate instead of ammonia is advantageous, inasmuch as increasing volume of liquidi or quantity of alkali, or copper, or cyanide, or the presence of alkal chlorides, nitrate, or acetates seriously derange the titration in the latter, but not in the former case (compare Thomson, *Chem. News*, 1880, **33**, 152, and J. J. and C. Beringer, Abstr., 1884, 113), except with nitrates, and this can be overcome by using greater excess of sodium carbonate; nitrates, acetates, and sulphates, however, but not chlorides, cause a more or less inky solution that masks the turbidity due to the silver iodide, but the addition of sodium chloride cures this defect. In the presence of ferric iron, the usual method is useless, the modified method successful, whilst in the presence of aluminium or manganese the results accord with the usual titration. Besides manganese, nickel, cobalt, zinc, mercury, silver, gold, platinum, and palladium interfere with the reaction. D. A. L.

Estimation of Mercuric Salts. By LUDWIG VANINO and F. TREUBERT (*Ber.*, 1897, **30**, 2808—2809. Compare Abstr., 1897, ii, 601).—The solution is mixed with excess of commercial hydrogen peroxide (containing hydrochloric acid), phosphorous acid is added, and the whole is warmed on the water bath until the precipitate of mercurous chloride has clotted; this precipitate is collected on a tared filter, dried at 105°, and weighed. In five experiments, the percentage of Hg found was 73·82—74·01; calculated 73·85. Phosphorous acid may thus be used as a reducing agent, instead of hypophosphorous acid; the hydrogen peroxide prevents a further reduction to metallic mercury, which otherwise would take place at the temperature of the water bath.

C. F. B.

Analysis of White Paints. By GUSTAVE W. THOMPSON (*J. Soc. Chem. Ind.*, 1896, **15**, 432—434, 791).—The pigments most frequently met with in the white paints of commerce are white lead, lead sulphate, zinc oxide, the so-called "sublimed white lead," which consists of lead sulphate with varying proportions of lead and zinc oxides, barytes, calcium sulphate, calcium carbonate, china clay, silica, zinc sulphide, and lead sulphite. For extracting the oil, the author prefers "C. P. benzol" although any of the usual solvents may be used; sufficient organic matter may remain, however, to render valueless any direct estimation of combined water. The exact course of the quantitative analysis will depend on the results of a previous qualitative examination, in which the solubility of all lead compounds (except sulphite), zinc oxide, and calcium salts in boiling acid ammonium acetate is mainly to be depended on. The methods recommended for the estimations are in the main those of the ordinary text-books; only the special methods are, therefore, noticed here. White lead is calculated according to circumstances either from a carbonic anhydride estimation, or from the lead soluble in acetic acid, the arbitrary formula, $2PbCO_3,PbH_2O_2$, being adopted. For the separation of lead compounds (other than sulphite) from barytes, china clay, &c., their solubility in acid ammonium acetate is made use of. Lead sulphate may be regarded as insoluble in acetic acid, and be thus separated from lead oxide and white lead. Since a mixture of lead sulphate and calcium carbonate cannot be treated with water without the occurrence of double decomposition, calcium sulphate cannot be dissolved out from a mixture of the three substances. The total calcium must be estimated in one portion, and another portion be treated with a cold mixture of 9 parts of 95 per cent. alcohol and 1 part of nitric acid (sp. gr. = 1·4), which dissolves the calcium carbonate and leaves the calcium sulphate. A gram of the sample is treated four times with this solvent, for 20 minutes each time, and the decanted and filtered liquids are evaporated to dryness. The residue is heated with excess of strong sulphuric acid until fumes appear, then dissolved in acidified ammonium acetate, freed from lead and zinc by hydrogen sulphide, and the calcium estimated as usual. M. J. S.

Separation of Aluminium from Beryllium by the Action of Hydrochloric Acid. By FRANKE S. HAVENS (*Amer. J. Sci.*, 1897, [iv], 111—114, and *Zeit. anorg. Ch.*, 16, 15—18).—The author, in a previous communication (Abstr., 1897, ii, 232), has proved that alumina may be completely separated from iron oxide by dissolving in hydrochloric acid, adding an equal bulk of ether, and saturating it with hydrogen chloride. The aluminium is then completely precipitated as chloride, which, after being washed with a mixture of acid and ether saturated with hydrogen chloride at 15°, is converted into oxide by ignition with mercuric oxide.

The author now states that the process is equally applicable in the presence of beryllium. After removing the aluminium as described, the filtrate is evaporated to dryness and the residue is converted into nitrate by evaporating with nitric acid. This, on strong ignition, leaves pure beryllium oxide.

The test analyses show the great accuracy of the process.

L. DE K.

Assay of Carbonated Manganiferous Minerals. By N. DEVISSE (*Chem. News*, 1897, 76, 212—213).—Manganese, when precipitated in the presence of oxidising agents, tends to form compounds of the general formula $5MnO_2,MO$; MO being manganous, zinc, calcium or other oxide: for example, by adding 1 equivalent of permanganate to four equivalents of manganous chloride, neutralising the liberated acid, all the manganese is precipitated in this form, as shown in the equation $4MnCl_2 + Mn_2O_8K_2 + 3H_2O = 5MnO_2,MnO + 2KCl + 6HCl$. The presence of zinc or lime salts might in this way affect gravimetric results, hence volumetric methods are advocated, and if precipitated zinc oxide is added prior to the treatment with permanganate in Volhard's method, then the chlorides need not be transformed into sulphates. D. A. L.

Estimation of Iron and Aluminium in Mineral Phosphates, Manures, Alum, &c. By ROBERT T. THOMSON (*J. Soc. Chem. Ind.*, 1896, 15, 868—869).—In an earlier paper on this subject (Abstr., 1887, 302), the precipitation of iron and aluminium phosphates, free from calcium, from a solution containing calcium phosphate, was effected by ammonium acetate strongly acidified with acetic acid. Gladding (Abstr., 1897, ii, 125) adopts the same method, with the condition that the solution be heated to 60°, but in either case several reprecipitations may be necessary to ensure complete absence of calcium from the precipitate. This difficulty appears to be a direct result of the presence of ammonium acetate, and the author, therefore, now reverts to his "neutralisation" method, which consists in the cautious addition of ammonia to the hydrochloric acid solution of the mixed phosphates, until sensitive blue lacmoid paper indicates that only a minute trace of free acid remains. One part of aluminium phosphate requires 3 parts, and 1 part of ferric phosphate 12 parts of free phosphoric acid to hold it in solution, so that with care in the neutralisation the precipitation of both is practically perfect, whilst the precipitate is completely free from calcium. The aluminium and iron phosphates so precipitated will be normal phosphates if the solution contained at least 1·5 times the theoretical proportion of phosphoric acid, otherwise they will be basic. This normal composition, and also the gelatinous condition, will be retained if the precipitate is washed with a 1 per cent. solution of ammonium nitrate containing 0·2 gram of ammonium dihydrogen phosphate per litre, this solution being, if necessary, carefully made neutral to methyl-orange by the addition of phosphoric acid. Although the portion of this solution retained by the drained precipitate will leave its phosphoric acid when the precipitate is ignited, the error is too small to be of importance. Should the substance under analysis contain calcium fluoride, the evaporation of its hydrochloric acid solution to dryness with nitric acid will eliminate the fluorine. The nitric acid should not be added until the hydrochloric acid solution has been filtered from any pyrites which the substance may contain, because this mineral is left unaffected in the manufacture of superphosphate, and its iron should, therefore, be reported separately.

The above process serves equally well for the separation of aluminium and iron from nickel, cobalt, zinc, manganese, and magnesium.

M. J. S.

Separations with Alkali Acetates. IV. Chromium from Iron. V. Aluminium and Copper from Iron. VI. Zinc from Iron. By Harry Brearley (*Chem. News*, 1897, **76**, 175—177, 210—211, 222—224. Compare Abstr., 1897, ii, 388, and this vol., ii, 96).—*Chromium* cannot be separated quantitatively from iron by means of sodium acetate either when much or little acetate or free acid is used, although the separation is better when the larger quantities are employed, especially with plenty of strong acetate. The separation, too, is better in the case of a chrome steel containing from several tenths to 2 or 3 per cent. of chromium than it is from solutions having 0·1 gram of chromium to 1 gram of iron. The imperfect separation is attributed to the formation of iron chromates, and it seems that aluminium forms similar compounds with iron, since no useful separation of *aluminium from iron* can be effected by alkali acetates, whether in the presence of much, little, or no acetic acid, or dissolved hydroxide. A much larger quantity of acetate is required to completely precipitate the iron in the presence of much aluminium, some of which is also precipitated. These factors might interfere with some of the separations, but in the case of steel there is usually a harmless amount of aluminium and as much as 60 c.c. of acetate and 10 per cent. of aluminium does not greatly upset the nickel and iron separation when 0·1 gram of nickel is present, but under such circumstances this separation would be rendered more perfect by using large amounts of ammonium chloride and less acetate; the use of alkali chromate is likewise mooted for this purpose.

The separation of *copper from iron* by acetate is not quantitative the presence of free acid, however, favours accuracy, although much acetate has the contrary effect, whilst Schwarzenberg's method is effective for this separation. To estimate copper in steel or iron compounds containing less than 0·5 per cent., the procedure when using sodium cyanide titration is as follows: 5 to 10 grams is dissolved in dilute sulphuric acid, the solution treated with hydrogen sulphide or preferably, with sodium thiosulphate, but only in slight excess, and the liquor poured off through a filter. The precipitate is washed by decantation, and after being mixed with the residue from the ignition of the filter paper, is heated with 10 to 20 c.c. of nitro-hydrochloric acid and potassium chlorate; when all but sulphur is dissolved, the solution is cooled, diluted, neutralised, made alkaline with sodium carbonate, and titrated with sodium cyanide, as described by the author (this vol., ii, 140).

The separation of *zinc from iron* can also be completely effected by the acetate method.

In all the separations by this method, it is to be remembered that the phosphoric acid is precipitated with the iron acetate; that the temperature at which the turbidity appears should be recorded; that cooling the solution before adding the acetate is only necessary when any large excess of acetate is used; that the decomposition of acetates on heating accounts for the presence of free acetic acid in the case of ferric acetate, and may account for some of the imperfect separations recorded by the author; that, knowing the amount of acid used for dissolving, the necessary quantity of alkali required for neutralising may be added at once and the rest several c.c. at a time until there is an unmistakably permanent turbidity, which turbidity is dissipated by adding 10 or 12 c.c. of acetic acid, but, on diluting with hot water and heating, should reappear at about 90°, otherwise a few c.c. of dilute acetate should be added; in this way, nickel in a nickel steel may be determined with great rapidity. D. A. L.

Estimation of Nickel and Zinc as Phosphate. By John Clark (*J. Soc. Chem. Ind.*, 1896, **15**, 866—868).—Experience has confirmed the value of the ammonio-phosphate process devised by Dirvell and modified by the author (Abstr., 1880, 287; 1884, 498; 1890, 1470) for the separation of cobalt from nickel, but the estimation of the nickel in the filtrate is less satisfactory. By adding dilute hydrochloric acid to the cold or moderately warm liquid until it is neutral or nearly neutral to test-paper, the nickel is precipitated as the double phosphate of the formula $NiNH_4PO_4 + 6H_2O$; this loses rather more than $5H_2O$ at 100°, and on ignition is converted into nickel pyrophosphate. It is slightly soluble in water, but if 20 per cent. of alcohol is added after neutralisation, and the precipitate is washed with cold water containing 10 per cent. of alcohol, the loss is unimportant. If the above process is applied to a mixture of cobalt and nickel salts in which the cobalt exists in the cobaltic state, the nickel only is precipitated. For this purpose, the solution containing the metals as chlorides is mixed with 10 times as much ammonium phosphate as the weight of metal present, and is heated for a few minutes with hydrochloric acid and a considerable excess of bromine. While free bromine is still present, the solution is supersaturated with ammonia and heated with hydrogen peroxide; it is then cooled, neutralised with dilute hydrochloric acid as above, and stirred. Alcohol is added, and after several hours the precipitate is collected and washed as above. When much cobalt is present, it may be desirable to re-dissolve in hydrochloric acid, add ammonium phosphate, oxidise, and reprecipitate as before. In this way, 1 part of cobalt may be detected and estimated even when accompanied by 200 parts of nickel.

The above method applied to an ammoniacal solution of zinc chloride, containing enough ammonium chloride to form a double salt, precipitates the whole of the zinc as $ZnNH_4PO_4$. This can be washed with cold water, is anhydrous after drying over sulphuric acid, but bears ignition (apart from the filter) without loss of zinc. To apply this method to zinc ores, the iron, alumina, and manganese are removed by ammoniacal hydrogen peroxide, and most of the calcium by ammonium carbonate added to the hot alkaline liquid. The rest of the calcium and the magnesium are thrown down when the ammonium phosphate is added, but this precipitate is free from zinc.

M. J. S.

Assay of Chrome Ore. By ELWYN WALLER (*J. Soc. Chem. Ind.*, 1896, **15**, 436—437)—The author reports his experience of the fusion of chrome ore with sodium peroxide in nickel crucibles (see Trans., 1893, 1079, and this vol., ii, 94). About 0·5 gram of ore in impalpable powder was weighed into a nickel crucible (35 mm. in diameter at the top, 30 mm. deep, and weighing 9—12 grams) and well mixed with about 2 grams of dry powdered sodium peroxide. The mass was fused by a small flame and after being kept in tranquil fusion for 8—10 minutes, the temperature was raised to a visible red heat, the crucible being moved for 1 minute in such a way as to give a rotatory motion to its contents. The cooled melt was dissolved in boiling water (50—80 c.c.), the solution boiled for 5 minutes to decompose excess of peroxide, some of which was always found to be present, then filtered, acidified with sulphuric acid, and after dilution to 600—700 c.c. titrated with standard thiosulphate (30 grams per litre), with the addition of potassium iodide (1·5—2 grams) and starch towards the end. Decomposition of the ore was complete; a single experiment with ore ground only until it would pass through a "60-mesh" sieve indicated that the method would probably serve for such coarse ore. Employment of a shallow basin instead of the crucible resulted in imperfect decomposition. The crucible lost 0·02—0·05 gram at each fusion. The use of a larger proportion of peroxide or a higher temperature caused a stronger attack of the crucible. Heavier crucibles than the above lost proportionally more.

M. J. S.

Estimation of Antimony in Ores and Metals. By JOHN CLARK (*J. Soc. Chem. Ind.*, 1896, **15**, 255—257).—If antimony or an antimony ore is dissolved in hydrochloric acid with the assistance of iodine, the oxidation does not proceed beyond the stage of trichloride, and after boiling off the excess of iodine, the solution is at once fit for titration by Mohr's method, using iodine solution in presence of an excess of alkali tartrate and sodium hydrogen carbonate. Should it be found on adding starch (after the boiling and cooling) that a trace of free iodine remains, this can be cautiously removed by adding sodium sulphite. Since, in acid solution, tin is oxidised to stannic chloride by iodine, it has no effect on the result. Lead is also inert, but in the presence of copper the results are too low; in this case, as also in presence of iron, it becomes necessary to precipitate the metals as sulphides and dissolve out the antimony sulphide by potassium hydroxide. The reprecipitated antimony sulphide is then dissolved by hydrochloric acid and iodine. Arsenic would also vitiate the results, but it can be removed by repeatedly boiling down with copious additions of strong hydrochloric acid. M. J. S.

Assay of Electro-plating and Gilding Solutions. By ALFRED H. ALLEN (*Chem. News*, 1897, **76**, 199).—Whilst approving Baker's method (this vol., ii, 93), the author prefers one he has long used, in which 20—50 c.c. of the plating solution, largely diluted with water and heated to boiling, is treated with hydrogen or ammonium sulphide, and the washed precipitate mixed with excess of bromine water, any sulphur in the residue being oxidised by the use of a small quantity of bromine. Boiling water is then added and the silver bromide washed, dried, fused, and weighed. Electro-gilding or silvering solutions are evaporated in a porcelain crucible to a syrupy consistency, and mixed with red lead or litharge; the mass dried, heated a short time at moderate redness, and the button cupelled, or, in the case of gold, treated with nitric acid, if preferred. D. A. L.

Preparation of Water Free from Ammonia. By JOSEPH BARNES (*J. Soc. Chem. Ind.*, 1896, **15**, 254—255).—Distilled water can be completely freed from ammonia by adding a little bromine and boiling for a few minutes. More rapid is the action of alkaline hypobromite in the cold. Enough bromine is added to the water to give it a perceptible tint, and then a drop of sodium hydroxide solution; after ten minutes, a little potassium iodide is added to remove the undecomposed hypobromite, and the water is then fit for use in the estimation of ammonia by Nessler's test. M. J. S.

Simplified Organic Analysis (*Supplementary Observation*). By MAXIMILIANO DENNSTEDT (*Ber.*, 1897, **30**, 2861—2962. Compare Abstr., 1897, ii, 432).—In analysing compounds containing nitrogen and halogen by the author's method, the percentage of halogens is often found too high, because the silver retains oxides of nitrogen. After the silver boat has been weighed once, it should be heated in a Bunsen flame till the silver haloids melt, and reweighed, any silver nitrate or nitrite is thus destroyed. It is well to do this in all cases, even when the substance analysed contains no nitrogen. C. F. B.

Formaldehyde as a Reagent. By HERMANN ENDEMANN (*J. Soc. Chem. Ind.*, 1896, **15**, 791—792).—Substances of the phenol class combine with formaldehyde, forming colourless compounds which become coloured on treatment with concentrated sulphuric acid. To obtain the reaction, the phenol is dissolved in commercial formalin, the solution evaporated nearly to dryness at a low temperature, and concentrated sulphuric acid added. The following reactions have been recorded.

	The solid.	The solution.
Phenol ……	Magenta-coloured …………………………	Magenta-coloured.
Salicylic acid	Red ……………………………………	Magenta.
Eugenol ……	Brown, with claret shade…………………	—
Carvacrol …	Orange to orange-red ……………………	—
Guaiacol …..	Violet, quickly brownish-violet ………..	—
Resorcinol …	Scarlet-red …………………………………	Orange.
Quinol ……	Brown ………………………………………	Brown.
Thymol ……	Faintly fawn-coloured (due to impurity ?)	—
α-Naphthol	Green ………………………………………	Brown.
β-Naphthol	Green, then black …………………………	Green.
Pyrogallol …	Red …………………………………………	—
Hæmatein …	Red, then brown …………………………	—
Tannin ……	No reaction…………………………………	—

Other aldehydes afford similar reactions, but the colours are different. Silk which has been treated with formaldehyde to render the sericin insoluble gives a different reaction with sulphuric acid (rich brown, passing through olive-green to green as moisture is absorbed) from that of silk not so treated. Washing the treated silk with hot water prevents the colour reaction from being obtained. M. J. S.

Fehling's Solution. By J. E. Gerock (*Ber.*, 1897, **30**, 2865—2867).—The author has tested Siegfried's statement (quoted by Jovitschitsch, this vol., ii, 98) that Fehling's solution undergoes a spontaneous reduction when alkaline sulphates, chlorides, or nitrates are dissolved in it, and found it to be erroneous.

The essential constituent of a Fehling's solution is a compound of the type $R\cdot O\cdot Cu\cdot O\cdot M'$ or $(R\cdot O\cdot Cu\cdot O)_2M''$, where M' is an alkali, M'' an alkaline earth, and R is an organic radicle not too readily oxidised. The author has used a solution in which the metal was barium and the organic substance salicylic acid. C. F. B.

Reactions of Potassium Ferricyanide with Glucose and their Applications to Volumetric Analysis. By N. Tarugi and G. Nicchiotti (*Gazzetta*, 1897, **27**, ii, 131—153).—See this vol., i, 118.

Optical Analysis of Urine and Exact Estimation of Proteids, Glucosides, and Non-fermentable Saccharine Materials. By Frédéric Landolph (*Compt. rend.*, 1896, **123**, 1301—1302).—Smlla amounts of sugar are best estimated by fermentation. When the sugar in urine is more than 10 grams per litre, it may be determined by the saccharimeter. The direct reduction coefficient can only be obtained with boiled and filtered urine, as otherwise a certain quantity of cuprous oxide remains in suspension; two indirect reduction coefficients should be determined. (1) The coefficient of the original urine after treatment with mineral acid, and (2) the coefficient of the boiled and filtered urine when treated in the same manner. The difference between these coefficients gives the amount of mucin, &c.,

present, and the difference between the direct and indirect coefficients of the boiled and filtered urine gives the amount of glucosides.

J. J. S.

Estimation of Diabetic Sugar. By FRÉDÉRIC LANDOLPH (*Compt. rend.*, 1897, **125**, 612—613).—The polaristrobometer alone indicates the real quantity of active diabetic sugar in a solution. The coefficient of reduction gives double or treble the amount of sugar indicated by the polaristrobometer. Determinations by the method of fermentation give results which vary greatly with the time that has elapsed between the end of the fermentation and the reading off of the volume of carbonic anhydride (compare Abstr., 1897, ii, 512).

C. H. B.

Quantitative Separation of Cellulose-like Carbohydrates in Vegetable Substances. By WILHELM HOFFMEISTER (*Landw. Versuchs-Stat.*, 1897, **48**, 401—411. Compare Abstr., 1890, 581).—To separate the hemicelluloses, celluloses, and the constituents of lignin without essential change, the substance, after being freed from fat, is extracted with dilute hydrochloric acid and ammonia, and the residue frequently agitated for a day or two with 5—6 per cent. caustic soda solution. It is then diluted, the extract poured off, neutralised with hydrochloric acid, treated with sufficient alcohol, and the hemicellulose filtered, dried, and weighed. The residue from the soda extract is washed on a filter with hot water, and extracted with Schweizer's reagent.

When the final residue (lignin) is subjected to prolonged extraction with boiling dilute ammonia (a suitable apparatus is described, with sketch) until the ammonia is no longer coloured, a residue is obtained which mostly dissolves in Schweizer's reagent, and on repeating the process the residue is found to consist largely of mineral matter. The dissolved cellulose-like substances often contain considerable amounts of pentosans.

According to the nature of the substance, the extraction with ammonia may take weeks, or months, or even longer; the ammonia extracts of hard woods (as *Lignum vitæ*), and of cork, are dark brown, and give an odour of vanilla when evaporated down. The residues, which are insoluble in water, but redissolve in ammonia, have the properties of humic acids. Other vegetable substances, when extracted, yielded, besides humic acids, a compound, $C_6H_7O_2$, soluble in alcohol and chloroform, but insoluble in water, ether, and benzene; preparations from different sources melted between 200° and 210°.

N. H. J. M.

General and Physical Chemistry.

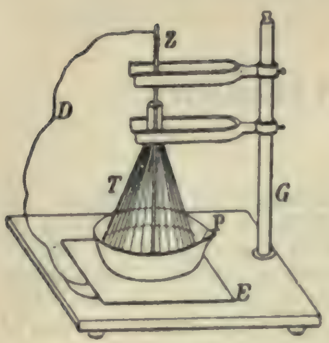
A New Agent for Increasing the Angle of Rotation. By Paul Walden (*Ber.*, 1897, **30**, 2889—2895).—Alkaline solutions of uranyl salts produce considerable increase in the angle of rotation of optically active substances dissolved in water or alcohol. The increase is associated with the presence of a hydroxylic group in the active substance, and reaches a maximum when the molecular proportion of hydroxy-compound to uranyl salt and alkali is 1 : 1 : 4.

In the case of *l*-malic acid, the angle of rotation is 500 times that exhibited by the original solution. M. O. F.

Influence of Altitude and Temperature on the Decomposition of Oxalic Acid by Light. By J. Vallot and Gabrielle Vallot (*Compt. rend.*, 1897, **125**, 857—858).—Experiments made at Chamounix (1095 m.) and at Montanvert (1925 m.) on the oxidation of solutions of oxalic acid by light, show that at the higher altitude the rate of change is much higher, the ratios of the amounts of decomposition at the two places varying from 1·5 to 2·9, with a mean of 2·1. The chemical activity of the light, therefore, increases very rapidly with the altitude. A considerable proportion of the chemically active rays is absorbed by even a comparatively thin layer of glass. In the course of the experiments, it was observed that, although heat alone does not decompose the oxalic acid solution, it very greatly accelerates the action of light.

The authors suggest that, in investigations into the laws of plant life, the combined effect of light and temperature must be considered rather than the effect of either of them alone. C. H. B.

Electrical Energy caused by the Direct Action of the Atmosphere. By Henry N. Warren (*Chem. News*, 1897, **76**, 200).—Plates are prepared of a special porous compressed graphite, and about one-quarter of each plate is rendered active by immersion in platinic oxalate, drying and igniting in an atmosphere of hydrogen. In contact with a solution of ferrous sulphate, the platinum surface induces oxidation of the iron by the oxygen of the atmosphere. Several of these plates are attached to a circular lead beam, which surrounds a porous diaphragm containing as negative element a rod of amalgamated zinc, the carbons being so arranged as to allow the platinised portion to project above the solution, which consists of strongly acidified ferric sulphate. On completion of the circuit, a powerful current is at once generated, and continues until the complete reduction of the ferric salt has taken place, which naturally terminates the action. On now withdrawing the zinc, the platinum surface condensing the atmospheric oxygen steadily re-oxidises the ferrous salt, and thus renews the action when required. H. C.



Simple Electrolytic Apparatus. By A. Gawalowski (*Chem. Centr.*, 1896, ii, 1075; from *Centralbl. Nahr. und Genussm.*, **2**, 343).—The electrolyte is placed in a platinum dish, *P*, which stands on a nickel plate, *E*. A small funnel, *T*, is placed over the dish, and through the stem of this a zinc rod, *Z*, is introduced, the funnel and rod being supported in a vertical position by the stand, *G*. The wire, *D*, connects *Z* with *E* and closes the circuit.

H. C.

Metallic Sulphide Electrodes. By Isidor Bernfeld (*Zeit. physikal. Chem.*, 1898, **25**, 46–73).—In electrolysis with electrodes of metallic sulphides, the following changes occur. (1) In acid solutions: at the anode, the metal is dissolved and the sulphur precipitated or oxidised; at the cathode, hydrogen sulphide is formed with separation of the metal; (2) in alkaline solutions: at the anode, the metal forms a hydroxide and the sulphur is oxidised; at the cathode, the metal is precipitated and the sulphur passes into solution as an ion. Lead sulphide was first employed for quantitative work, and it was observed that the resistance of this compound decreases with rise of temperature, although the conduction is purely metallic. In alkaline solutions, the quantity of lead precipitated and of sulphur dissolved at the cathode was found to be in complete accord with Faraday's law. The electrodes are best prepared electrolytically from pure lead, and by means of such electrodes a constant E. M. F. may be obtained in sodium sulphide solutions, if alteration in the latter is prevented by passing a continuous current of hydrogen sulphide. Measurements of the E. M. F. of lead sulphide in solutions of sodium sulphide at different concentrations, indicated the univalency of the ions, which the author hence considers to be $-SH$. The current passes from the more highly to the less concentrated solutions, and the changes occurring at the electrodes may be thus represented: $PbS + SH_2 \rightleftarrows Pb + 2SH-$, in the more dilute solution, therefore, two SH ions are formed and one undissociated SH_2 disappears, whilst the reverse obtains in the more concentrated solution. The E. M. F. is hence given by the equation $\pi = RT/\epsilon \times \log c_1/c - RT/2\epsilon \times \log c'_1/c'$, where c_1, c are the concentrations of the ions and c'_1, c' are the concentrations of the undissociated hydrogen sulphide. When the concentration of the hydrogen sulphide was kept constant, that is, $\log c'_1/c' = 0$, the E. M. F. was found to agree well with the calculated value. Further, by the use of equally concentrated sodium hydrosulphide solutions saturated with hydrogen sulphide at different pressures, an E. M. F. was obtained which agreed satisfactorily with the value calculated from the expression $\pi = -RT/2\epsilon \times \log c'_1/c_1$. By the use of electrodes of silver sulphide and of bismuth sulphide, similar results were obtained, so that, as the expression shows, the electromotive force is independent of the valency of the metal. By the use of cells of the type: silver | N/1 silver nitrate | N/1 sodium hydrosulphide | silver sulphide, the solubility of the silver sulphide, &c., may be found; the values thus obtained for the silver, lead, and bismuth sulphides are respectively $3\cdot4 \times 10^{-22}$, $2\cdot9 \times 10^{-5}$, and $2\cdot1 \times 10^{-26}$. L. M. J.

Electrical Conductivity in Mixed Solutions of Electrolytes. By K. Hopfgartner (*Zeit. physikal. Chem.*, 1898, **25**, 115—143).—In a solution of two different electrolytes, if n_1 and n_2 be the concentrations of the cations and u_1, u_2 their migration velocities, then the ratio of the number of the respective cations passing in the same time across any section towards the cathode is given by n_1u_1/n_2u_2. If this ratio, d_1/d_2, be directly obtained from the alteration of the anode liquid, then if the migration velocities are known, the concentrations of the ions can be calculated $n_1/n_2 = u_2d_1/u_1d_2$. The ratios of the concentrations of the hydrogen and sodium ions were thus obtained in the case of mixtures of equally concentrated solutions of sodium chloride and hydrogen chloride, and the values compared with those obtained by means of Rudolphi's expression. The agreement was satisfactory, indicating that the admixture of these highly dissociated solutions has little effect on the dissociation. In the case of mixtures of similar hydrogen chloride and barium chloride solutions, however, the agreement was not good, probably owing to the assumption that the dissociation of the barium chloride is entirely to Ba'' and Cl ions. The values of the transference ratios of the ions was also obtained for the three salts examined at different dilutions; for sodium, the transference number increases with increasing dilution, whilst for both barium and hydrogen the reverse was found to obtain. The quantity of the cations deposited as a result of the purely electrical action was calculated from these numbers, and the results were found to agree well with the silver deposited in a voltameter included in the circuit. L. M. J.

Source of Error in the Determination of the Heat of Dissociation of Electrolytes. By J. J. van Laar (*Zeit. physikal. Chem.*, 1897, **24**, 608—614).—The equilibrium equation in the case of a dissociation process is $c_2^x,c_3^y/c_1 = k$, where x and y are the numbers of the different ions resulting from the dissociation. The concentrations c_1, c_2, and c_3 are given by the expressions $(1-a)c/(1+\beta)$, $xac/(1+\beta)$, $yac/(1+\beta)$, that is, are functions of β, the degree of dissociation of the solvent. Hence, since by temperature change the degrees of dissociation of both solute and solvent are directly altered, it follows that the degree of dissociation, a, of the solute undergoes, not only the direct change due to temperature, but also a secondary change due to the alteration of the concentration. On this account, the heat of dissociation is not accurately given by the ordinary expression $q = RT^2 d\log k/dt$, but by an extended expression, $RT^2\{d\log k/dt - (x+y-1)d\log(1+\beta)/dt\}$. In the case of potassium, the author shows that the omission of the second term leads to an error of 100 per cent., its value being calculated by the aid of Ramsay's determinations of the association factor of water at different temperatures. L. M. J.

Temperature Coefficient of the Potential of Calomel Electrodes, with various Dissolved Electrolytes. By ALBERT GOCKEL (*Zeit. physikal. Chem.*, 1897, **24**, 703—704).—Richards, in his paper on the above subject (this vol., ii, 7), has completely overlooked the author's second paper (Abstr., 1894, ii, 78), in which several of Richards' results were previously obtained, and corrections had been made of the values given in the first paper, the only one cited by Richards. L. M. J.

Thermoregulator. By F. FRIEDRICHS (*Zeit. anal. Chem.*, 1897, **36**, 674).—This thermoregulator is very similar in principle to that of Reichardt, but has the inlet and outlet channels for the gas drilled obliquely through the plug of a stopcock, and meeting at the top of a mercury tube. M. J. S.

New Method of Determining Melting Points. By MARIUS L. Q. VAN LEDDEN HÜLSEBOSCH (*Zeit. anal. Chem.*, 1897, **36**, 685—686; from *Pharm. Centralhalle*, **37**, 231).—In a case in which the small amount of the material, and the presence of adhering wool, precluded the use of the capillary tube, the substance was placed in an aluminium vessel, shaped like a watch-glass, floating on water in a beaker which was warmed in a water bath. The substance was watched through a lens, and the water temperature observed at the moment when the change in the lustre of the powder indicated that the melting point was reached. M. J. S.

Gradual Change and Thermodynamics. A Correction. By PIERRE DUHEM (*Zeit. physikal. Chem.*, 1897, **24**, 666).—The author corrects an erroneous differential equation which occurs in his paper on the above subject (Abstr., 1897, ii, 439), but which does not affect the deductions obtained by its use. L. M. J.

The Relation between the Heat of Solution, Solubility, and Dissociation. By HEINRICH GOLDSCHMIDT and GERTRUD VAN MAARSEVEEN (*Zeit. physikal. Chem.*, 1898, **25**, 91—99).—The expressions deduced by van't Hoff (1) and by van Laar (2) for the heat of solution of a binary electrolyte are respectively (1) $d\log c/dt = Q/2(1+a)T^2$ and (2) $d\log c/dt = Q(2-a)/4T^2$ (Abstr., 1895, ii, 484). As Rudolphi, when determining the heat of the solution of some silver salts (Abstr., 1895, ii, 435), did not determine the solubilities, the authors have redetermined the solubilities, degrees of dissociation, and heat of solutions of the saturated solutions of silver acetate, propionate, isobutyrate, and orthonitrobenzoate. The degree of dis-

	Found.	Calc. 1.	Calc. 2.
Silver acetate	−4613	−4828	−4369
,, propionate	−3980	−4155	−3789
,, isobutyrate	−2860	−3010	−2715
,, orthonitrobenzoate	−7083	−7925	−7167

sociation was calculated from the conductivity, and the heat of dissolution of the salts obtained directly by their precipitation from solution in a platinum calorimeter. The values obtained in this way are compared with those calculated, using the above formulæ. It is seen from the accompanying table that neither formula is entirely satisfactory, the values obtained experimentally lying between those given by the two formulæ. L. M. J.

Condensation and Critical Phenomena of Mixtures of Two Compounds. By J. P. Kuenen (*Zeit. physikal. Chem.*, 1897, **24**, 667—696).—See Abstr., 1896, ii, 10; 1897, ii, 544.

Association or Dissociation? By Hans Jahn (*Ber.*, 1897, **30**, 2982—2993).—A reply to the objections which have been put forward by Crompton (Trans., 1897, 925) and Traube (this vol., ii, 109) to the theory of electrolytic dissociation. The author maintains that Crompton's objections have been already dealt with by Planck, and have been satisfactorily and completely removed by him in his thermodynamical treatment of the subject (see Planck's *Vorlesungen über Thermodynamik*). Traube's view that combination takes place between the solvent and the dissolved substance, and that in the case of non-electrolytes one molecule of the dissolved substance always unites with but one molecule of the solvent, is improbable. It does not serve to explain the facts, as the formula of Poynting, on which Traube bases his further conclusions, is incorrect. It also necessitates the assumptions that, in the case of electrolytes, one molecule of the dissolved substance enters into combination with a greater and greater quantity of water as the dilution increases, and that the molecular conductivity of electrolytes does not alter with the concentration. H. C.

Dissociation of Nitric Peroxide. By K. Schreber (*Zeit. physikal. Chem.*, 1897, **24**, 651—665).—If the dissociation of nitrogen peroxide be represented by $N_2O_4 \rightleftarrows 2NO_2$, then the equilibrium constant is given by the equation $k = c_2^2/c_1 = a.e^{-b/T}.T/p$, where c_2 and c_1 are the concentrations of the complex and simple molecules, and a and b are constants. If γ be the degree of dissociation, $c_2 = 2\gamma/(1+\gamma)$ and $c_1 = (1-\gamma)/(1+\gamma)$, and if D and d be the densities of the N_2O_4 and the actual gas $\gamma = (D-d)/d$. The above equation then reduces to $4(D-d)^2/D2(d-D) = a.e^{-b/T}.T/p$, and the author investigated Natanson's determinations of the density (Abstr., 1885, 862; 1886, 657) in order to find whether the observations are in accord with this relationship. Allowing experimental errors of $\frac{1}{3}$ per cent. in the densities of the dissociated gas, and of 0·1 per cent. in the density of the N_2O_4, the possible error in the degree of dissociation is calculated for each of Natanson's experiments. In some cases, the error is found to exceed 100 per cent., and only those experiments where it is less than 10 per cent. are used for comparison with the theory. It is thus found that, at equal temperatures, the value kp is approximately constant, and that it increases rapidly with the temperature. Expressing the relationship in the form $\log(kp/T) = \log a - b(\log e)/T$, it was found that the values of kp are fairly accurately reproduced by the use of the constants $\log a = 9.13242$ and $b \log e = 2866.2$. The dissociation is hence considered to proceed normally and in accord with theory. From the value of the temperature coefficient of the dissociation degree, the value $13132 + 2T$ is obtained for the heat of dissociation, a result in close accord with that calculated by van't Hoff from Deville and Troost's experiments, namely, 12900. The apparent specific heat of the gas had been determined by Berthelot and Ogier, and from these results, allowing for the thermal effects of the dissociation changes, the author obtains the following values for the molecular heats.

	c_p.	c_v.	c_p/c_v.
N_2O_4	14·85	12·85	1·155
NO_2	8·43	6·43	1·31

These results are in accord with the experimental determination of the ratio of the specific heats, namely, 1·17 for 84 per cent. N_2O_4, and 1·31 for NO_2 (by extrapolation). L. M. J.

Dissociation in Mixed Salt Solutions. By ANDREAS FOCK (*Zeit. physikal. Chem.*, 1898, **25**, 74—78).—The author further contests the validity of Nernst's solubility law (Abstr., 1897, ii, 481). The solubility of mixed crystals of potassium and ammonium chlorides is also considered. Representing the concentration of the ammonium chloride in the solutions and crystals by c and x respectively, then from the values of c/x the value of the dissociation γ is calculated which leads to a constant ratio for $c(1-\gamma)/x$, the equilibrium ratio if the salt is undissociated in the solid. From this value of γ, the ratio $c\gamma/\sqrt{x}$ is obtained, leading to a value which is constant, within the limits of experimental errors, so that the partition law is valid for such solutions. L. M. J.

Dissociation of Compounds Dissolved in Mixtures of Alcohol and Water. By ERNST COHEN (*Zeit. physikal. Chem.*, 1898, **25**, 1—45). In order to completely investigate the dissociation of compounds dissolved in aqueous alcohol, the author determined the electrical conductivity of solutions of potassium iodide, the dilution varying from 64 to 2048, and the alcoholic content from 0 to 100 per cent. (volume); the apparatus and the method of preparation of the solutions are fully described. It is noteworthy that, at dilutions above 512, the conductivity in absolute alcohol is greater than that in 80 per cent. alcohol, whereas at lower concentrations the reverse obtains, so that in the former case the addition of water lowers the conductivity. If the conductivity of the alcoholic solution be referred to that of the pure aqueous solution at equal dilution, it is found that the value obtained depends only on the alcoholic content and not on the dilution. This holds for solutions containing less than 80 per cent. of alcohol, but above this value the ratio increases with dilution. By examination of Wakeman's results (Abstr., 1893, ii, 257), it is found that the same constancy obtains for solutions of potassium chloride, sodium chloride, hydrogen chloride, and sodium acetate, whilst the experiments of Walker and Hambly (Trans., 1897, 72) show that, below 50 per cent. of alcohol, the same result obtains for solutions of diethylammonium chloride. From this, it follows that the molecular conductivity of a solution in aqueous alcohol may be obtained from that of the equivalent aqueous solution by multiplying by a factor which is independent of the dilution. These factors are given for the various salts examined, and it is further seen that the factor is independent of the nature of the dissolved salt, and depends solely on the alcoholic content, being but little, if at all, affected by changes of temperature. As this result may be extended to infinite dilution, it follows that substances which obey the dilution law in aqueous solution do so also in solutions in aqueous alcohol, and conversely. As the degree of dissociation in aqueous solution is given by the expression $a = \mu_v/\mu_\infty$, that in the solution in aqueous alcohol is obtained by the expression $a_1 = k\mu_v/k\mu_\infty$, and hence $a_1 = a$; the replacement of water by alcohol, therefore, has no effect on the degree of dissociation of the dissolved material. The velocity of inversion of cane-sugar by hydrogen chloride is, however, diminished by the addition of alcohol, that is, the dissociation is decreased; the author hence considers it doubtful whether the electrical conductivity affords a trustworthy measure of the dissociation. L. M. J.

Dissociation of Dibasic Organic Acids. I. By W. A. Smith (*Zeit. physikal. Chem.*, 1898, **25**, 144—177).—An expression was obtained by Noyes for the dissociation of the acid ion of the acid salt of a weak dibasic acid (Abstr., 1893, ii, 365), and the laws were enunciated that, (1) the hydrogen dissociation decreases with proximity of the acid groups, (2) the introduction of new groups influences the dissociation of the acid and of the acid salt in the same manner; the author endeavours to see to what extent these laws are valid. The method of sugar inversion as a means of measuring the hydrogen ion concentration was first studied. At 100°, the rotation of sugar solutions in pure water rapidly changes, the change being partly due to inversion and partly to decomposition; it is, moreover, irregular, so that different experiments give different results, but on adding hydrogen sodium succinate, the rate of inversion becomes perfectly regular, the disturbing influences of the pure water being eliminated; in this case, the inversion is due entirely to the hydrogen ions. Neutral salts of weak acids have a similar protective influence, and the sugar changes only very slowly, whereas the salts of strong acids give curves of inversion which, like those due to water, are irregular. With completely dissociated hydrochloric acid, a perfectly satisfactory equation constant was obtained, and experiments were then performed to ascertain whether the velocity of inversion is proportional to the concentration of the hydrogen ions; this was found to be accurately the case for highly dissociated compounds, but with weakly dissociated compounds this proportionality apparently did not exist, the values for the dissociation being obtained from the conductivity experiments of Ostwald and Kohlrausch. As the ratio of the inversion velocity to hydrogen concentration only slowly decreases with dilution in the case of the organic acids, it follows that the undissociated acid has but slight influence on the inversion, whereas the influence of the undissociated hydrochloric acid is very considerable. L. M. J.

Equilibrium between Ammonium Nitrate and Ammonia. By Basil B. Kuriloff (*Zeit. physikal. Chem.*, 1898, **25**, 107—111).—Dry ammonia is absorbed by ammonium nitrate with the formation of a liquid which has been, by various observers, supposed to consist of different additive compounds of the two substances. The author's observations on the dissociation pressure of the liquid had previously led to the supposition that no such compound existed, but that the liquid was a solution of the nitrate in ammonia. In order to test the accuracy of this view, the author has determined the composition of the liquid, which is in equilibrium with a solid phase at temperatures ranging from about − 80° to + 168°. The curve indicates the existence of a solid phase, probably $NH_4 \cdot NO_3, 3NH_3$, at temperatures below − 40°, but above this temperature the curve is perfectly unbroken, being the curve of equilibrium between solid ammonium nitrate and the solution, so that above − 40° no compound of the two components exists. L. M. J.

Equilibrium in the Systems, Ether-water and Ether-water-malonic Acid. By Eduard A. Klobbie (*Zeit. physikal. Chem.*, 1897, **24**, 615—632).—The equilibrium of water and ether was first determined, the composition of the two layers being found at temperatures varying from − 4° to + 95°. Between these limits, the percentage of water in the upper layer increased from 0·94 to 2·71, whilst between − 4° and 82° the percentage of ether in the lower layer decreased from 12·63 to 2·7. Above about 80°, however, the percentage again increases, as no turbidity is caused by heating a liquid with 2·5 per cent. of ether, whilst a 2·7 per cent. solution, which becomes turbid at about 82°, is again clear at 115°. The solubility of malonic acid in water and ether was determined at temperatures varying from 0° to 132°, the melting point of the acid, after which the composition was found of the two layers formed when malonic acid is added to ether and water at 15°; the conjugate points of the binodal curve are thus obtained. The composition of the liquid in equilibrium with the solid acid was also found, and the equilibrium field is thus divided into three regions, where exist, (1) two liquid phases, (2) homogeneous liquid, (3) liquid and solid phase, and the composition of the phase for any original mixture is readily obtained from the diagram. The partition coefficient of the acid is not constant, a result which must necessarily obtain since the compositions of the solvents alter on the addition of the acid. By graphical extrapolation, however, the limiting value of 7 is found, which is still not the partition coefficient between ether and water but between the two ether-water solutions.

L. M. J.

Application of the Law of Mass-action to Researches on the Equilibrium between β-Naphthol and Picric Acid in Benzene Solution. By Basil B. Kuriloff (*Zeit. physikal. Chem.*, 1897, **24**, 697—702).—In the author's experiments on the equilibrium of solutions containing the above three components (this vol., ii, 112), the greater portion of the isotherm for 29·5° corresponds with the naphthol-picrate solid phase. The mass-action law may be applied to this part of the curve, and considering the dissociation to be

$$C_{10}H_7\cdot OH,C_6H_2(NO_2)_3\cdot OH \rightleftarrows C_{10}H_7\cdot OH + C_6H_2(NO_2)_3\cdot OH,$$

then if dissociation be complete, the product of the concentration of the components should be constant. This is not actually the case, but as the product only varies slightly, the dissociation is probably very considerable. Calculations of the degree of dissociation and of the dissociation constant are made, but the agreement of the values for the latter is not satisfactory. Evidence of the high dissociation is also obtained from the cryoscopic and boiling point observations, which lead to a molecular weight of about 195, in place of 373, and hence indicate dissociation to the extent 0·88. The author also points out that cryoscopic observations do not indicate the formation of compounds between solvent and solute, so that any indication of the formation of hydrates is only obtainable when solvents other than water are employed. (Compare Abstr., 1897, ii, 397.) L. M. J.

Aqueous Solutions of Two Salts with One Common Ion. By C. HOITSEMA (*Zeit. physikal. Chem.*, 1897, **24**, 577—607).—Representing the salts by XY and ZY, then in a saturated solution of the former, if A is the total concentration and d the degree of dissociation, $A(1-d)=kA^2d^2=$ constant. If ZY be added and x, y, z, be the concentrations of the respective ions, and a that of the salt ZY, of which d_2 is the degree of dissociation, then the equations of equilibrium are $xy=A^2d^2$; $(a-z)/zy=a(1-d_2/a^2d_2{}^2$; $x+z=y$ and the total solubility of $XY=x+A(1-d)$ affords a means of ascertaining the validity of the results. It follows from these equations that the concentration of XY must fall on the addition of ZY, but cannot sink below the value $A(1-d)$, remaining constant when this minimum is reached. Three types of curves are thus obtainable where the solubility of (1) neither salt, (2) one of the salts, (3) both salts reaches this minimum. In some cases, however, the addition of ZY is known to cause either an immediate increase in solubility or a decrease followed by an increase, and in such cases reactions occur between XY and ZY. The author first considers the effect of the formation of a *double* salt, that is, a compound XY,ZY which dissociates into XY and ZY. The equations of equilibrium are obtained, and it is seen that addition of ZY must at first cause a decrease of solubility of XY, but that, as formation of the double salt increases, the solubility may reach a minimum and afterwards increase, and the forms of the curves are given for the several cases in which (1) ZY, (2) XZY_2 first reaches its saturation concentration. In the case where *complex* salts are formed, the effects are different, the term complex salt being restricted to the compound dissociating into new ions, X and ZY_2 (Morgan, Abstr., 1895, ii, 478; Kahlenberg, Abstr., 1896, ii, 6). In this case, at first no ZY molecules exist in solution, and hence no Y ions. The solubility of XY, therefore, increases until the saturation concentration of $X(ZY_2)$ is reached, after which it decreases owing to the precipitation of this solid. A similar result is obtainable for the effect of XY on the solubility of ZY, so that the complete curve consists of four parts corresponding with the solid phases XY, X(ZY_2), Z(ZY_2), ZY. When mixed crystals are formed, the conditions of equilibrium are more complicated, owing to changes in the solid phase. If the composition of the crystals changes continuously, a continuous curve is obtained, which may or may not exhibit maxima and minima, but if the composition of the crystals changes abruptly at definite concentrations, curves of at least two distinct parts result, which may be further complicated by the existence of double salts. L. M. J.

Solubility and Decomposition of Double Salts in Water. By EBERHARD RIMBACH (*Ber.*, 1897, **30**, 3073—3089).—The crystallographic properties and solubilities of the double cadmium chlorides investigated are given below.

Salt.	Cryst. system.	Solubility.
1. $NH_4Cl,CdCl_2$	Rhombic	$^{105\cdot9^\circ}_{2\cdot4^\circ}\,P = 29\cdot88 + 0\cdot2144\,t.$
2. $4NH_4Cl,CdCl_2$	Hexagonal	Is decomposed.
3. $KCl,CdCl_2 + H_2O$	Monoclinic	$^{105^\circ}_{2\cdot6^\circ}\,P = 22\cdot20 + 0\cdot2901\,t.$
4. $4KCl,CdCl_2$	Hexagonal	Is decomposed.
5. $BaCl_2,2CdCl_2 + 5H_2O$	Regular	$^{107\cdot2^\circ}_{22\cdot6^\circ}\,P = 40\cdot80 + 0\cdot1988\,t.$
6. $BaCl_2,CdCl_2 + 4H_2O$	Triclinic	$^{108^\circ}_{22\cdot5}\,P = 35\cdot78 + 0\cdot2678\,t.$
7. $MgCl_2,2CdCl_2 + 12H_2O$	Rhombic	$^{121\cdot8^\circ}_{2\cdot4^\circ}\,P = 45\cdot98 + 0\cdot16505\,t.$

Double chlorides of the type $4MCl,CdCl_2$ are decomposed by water according to the equation $4MCl,CdCl_2 \rightleftarrows MCl,CdCl_2 + 3MCl$. The reaction proceeds in the direction right to left with an increase of temperature, but in the reverse direction as the temperature sinks. On diffusion, the double chlorides, Nos. 5, 6, and 7, undergo decomposition, and in all cases the cadmium chloride passes through the membrane less readily than the other constituent.

On comparing the solubilities of the double salts with those of their constituents, it is found that the value dp/dt (that is, the increase in solubility with the temperature) is much greater for the double salts than for their constituents. The solubility of any of the double chlorides at 0° always lies between the solubilities of its two constituents at that temperature. J. J. S.

Validity of the Dilution Law. By J. J. VAN LAAR (*Zeit. physikal. Chem.*, 1898, **25**, 79—90).—The author, in considering the causes of the divergences from Ostwald's dilution law which are exhibited by many aqueous and alcoholic solutions, is led to the important conclusion that, although the ratio μ_v/μ_∞ yields a degree of dissociation, yet this value is not that which obtains in the absence of the current; the dissociation thus determined is, therefore, incorrect. The cause of the alteration of the dissociation during the passage of the current is, in the author's opinion, the great difference which exists between the temperature of the actual conducting ions and the salt molecules, and that of the liquid as a whole. L. M. J.

Transition Point of a Solid Solution. By VICTOR ROTHMUND (*Zeit. Physikal. Chem.*, 1897, **24**, 705—720).—The author first shows that, in the case of a solid solution, the effect of the solute on a transition temperature of the solvent is completely analogous to the cryoscopic effect in a liquid solution. The depression of the transition temperature is hence given by the equation $t_0 - t_1 = RT^2/\phi \cdot (c_2 - c_1)$, where ϕ is the heat of transition and c_2, c_1 the concentrations of the solute in the two solid phases. If n be the ratio of the molecular weights of the solute in the two solutions, then $c_1/c_2^n = k$, so that for the case where the molecular weights are equal, $t_0 - t_1 = RT^2/\phi \cdot c_2(1 - k)$; that is, the lowering of the transition temperature is proportional to the concentration of the solute, a result which does not obtain, however, if the molecular weights differ. Experiments were made with solutions of carbon tetrachloride in carbon tetrabromide, in which cases solid solutions are formed, whilst the bromide exists as monoclinic and regular crystals with a transition point of about 46°. The temperature was determined by a thermometric method which practically amounts to the observation of a break in the curve of cooling. The solid solutions of the two compounds were obtained by precipitating their solution in alcohol by means of water, but, as the composition of the precipitate was not identical with that of the mixture dissolved originally, corrections for the depression of the transition point had to be applied, these corrections being experimentally obtained by redissolving the precipitate and again performing the experiment. The results indicate a constant value for the molecular depression and hence that the tetrachloride possesses the same molecular weight in the two solid solutions. As, further, the molecular structures of isomorphous compounds are similar, it follows that the two modifications of the tetrabromide possess equal molecular weight, so that the polymorphism is not due to polymerism. L. M. J.

Elementary Chemical Considerations. By F. Wald (*Zeit. physikal. Chem.*, 1897, **24**, 633—650).—The author, in continuation of previous papers, endeavours to show that no necessity exists for the assumption of the atomic hypothesis for the explanation of chemical phenomena. He considers the case of a chemical operation (an analysis) undertaken with the aid of materials the composition and nature of which are completely unknown, and shows that the chemist is guided, although perhaps unconsciously, by a phase law which he calls the $(N+1)$ rule; he gives definitions, based upon Gibbs' phase law, of identical and dissimilar materials and of a chemical compound (Abstr., 1897, ii, 308). L. M. J.

Inorganic Chemistry.

Reduction of Sulphurous Acid to Hydrogen Sulphide. By Eduard Donath (*Zeit. anal. Chem.*, 1897, **36**, 663—665).—Sulphurous acid is readily reduced to hydrogen sulphide by a hot solution of stannous chloride strongly acidified with hydrochloric acid. The sulphurous acid or sulphite solution must be added slowly, or the hydrogen sulphide formed will react with sulphurous anhydride, causing separation of sulphur. This fact may be applied to the detection of arsenic and antimony in presence of much tin. A further quantity of strongly acid stannous chloride is added, and to the boiling liquid a solution of sodium sulphite or sulphurous acid is added in drops. Arsenious and antimonious sulphides are precipitated, the tin is not. The same method may be applied to the detection of arsenic in commercial sulphuric acid. M. J. S.

Action of Hydrogen on Sulphuric Acid. By MARCELLIN P. E. BERTHELOT (*Compt. rend.*, 1897, **125**, 743—746).—A slow current of hydrogen can be passed for an hour through concentrated sulphuric acid at the ordinary temperature without any appreciable production of sulphurous anhydride, but if contact between the gas and the acid is prolonged, the gas is absorbed and the acid is reduced. Light has no distinct influence on the reaction. Dilute sulphuric acid is not reduced by the hydrogen. At 250°, with the concentrated acid, reduction takes place somewhat rapidly, especially in presence of a considerable excess of acid. When mixtures of hydrogen and oxygen are left in contact with sulphuric acid either at the ordinary temperature or at 250°, both gases are absorbed, but the rate of absorption of hydrogen is the same as in the absence of oxygen, and the absorption of oxygen is due to its combination with the sulphurous anhydride that is formed. Dry hydrogen and sulphurous anhydride do not interact at 100° or 280°.

The reduction of concentrated sulphuric action by hydrogen is an exothermic reaction and develops + 15·1 Cal., this value being increased to + 30·1 Cal. in presence of a large excess of sulphuric acid, owing to the heat of hydration. In the case of dilute sulphuric acid, the reaction would be endothermic. C. H. B.

Phosphorous Oxychloride. By J. ADOLPHE BESSON (*Compt. rend.*, 1897, **125**, 771—772).—The action of a small quantity of water, whether in the liquid form, or as atmospheric moisture, on phosphorus trichloride, produces *phosphorous oxychloride*, POCl, which is isolated by distilling off the trichloride, at first on a water bath and finally under low pressure. This oxychloride is a yellowish, hyaline solid of the consistence of paraffin, with an odour recalling that of the oxychloride, $POCl_3$. It is very hygroscopic, and dissolves in water with a strident noise, the products being hydrochloric acid, phosphorous acid, and a small quantity of an amorphous yellow solid. It is rapidly decomposed by light with formation of a pale yellow precipitate which changes to reddish-yellow if the action of light is prolonged. The oxychloride is insoluble in most solvents, but dissolves in phosphorus trichloride. It combines slowly with chlorine, and yields phosphoric oxychloride, $POCl_3$.

The yield of phosphorous oxychloride is always very small, probably because its formation is limited by its extremely hygroscopic nature.

C. H. B.

Evolution of Helium from a Natural Compound with Production of Heat and Light. By JULIUS THOMSEN (*Zeit. physikal. Chem.*, 1898, **25**, 112—114).—Many years ago, the author observed the production of light and heat when a mineral occurring among the cryolite beds was raised to a low red heat. The mineral consists chiefly of calcium fluoride with a small quantity of the fluorides of cerium and yttrium, and by heating in a vacuous tube it was found that helium was evolved, together with some hydrocarbon. The helium may also be obtained by heating the powdered mineral with copper oxide and absorbing the carbonic anhydride. Experiments were also undertaken to determine whether the evolution of helium also accompanied the luminosity observed on heating specimens of fluor spar, but the results were negative. L. M. J.

Ammonium Peroxide. By PETR G. MELIKOFF and L. PISSARJEWSKY (*Ber.*, 1897, **30**, 3144—3146).—The authors' investigation of the salts of peruranic acid (this vol., ii, 165) has rendered it probable that these are compounds of metallic peroxides with peruranic acid. If this view is correct, the hydrogen ammonium salt is a compound of the acid with ammonium peroxide, a substance which has not been hitherto obtained. The present paper gives evidence of the existence of this substance.

When a concentrated, ethereal solution of hydrogen peroxide at $-20°$ acts on an ethereal solution of ammonia at the same temperature, a heavy, viscous liquid separates in quantity depending on the temperature of the mixture; the odour of ammonia diminishes in strength, although the heavy liquid, owing to partial dissociation, has a faint odour of ammonia after careful washing with cooled ether. Ammonium peroxide is strongly alkaline, and when treated with caustic potash yields ammonia and potassium peroxide; it dissociates readily into ammonia and hydrogen peroxide, which is also formed under the influence of dilute sulphuric acid. It irritates the skin, on which it produces white stains; it is insoluble in ether, but dissolves readily in alcohol. An aqueous solution liberates oxygen, at first slowly, then very vigorously, a small proportion of ammonium nitrite being formed.

If the ethereal mixture of ammonia and hydrogen peroxide is cooled in solid carbonic anhydride, acicular leaflets separate, consisting of a compound of ammonium peroxide and hydrogen peroxide, of the composition $(NH_4)_2O_2,2H_2O_2 + 10H_2O$. M. O. F.

Preparation of Carbides by the Action of Calcium Carbide on Oxides. By HENRI MOISSAN (*Compt. rend.*, 1897, **125**, 839—844).—When calcium carbide is fused in the electric furnace with certain metallic and non-metallic oxides, the corresponding carbides are obtained usually in a crystalline form. Aluminium oxide yields the carbide C_3Al_4, in yellow crystals; trimanganese tetroxide, the carbide CMn_3; chromic oxide, the carbide C_2Cr_3; molybdenum dioxide, the carbide CMo_2; tungstic anhydride, the carbide CW_2; titanium dioxide, the carbide CTi, and silica yields silicon carbide. Lead, bismuth, and tin oxides, and oxides of other metals that do not form definite carbides, are reduced to the metallic state. In all cases, the calcium carbide is converted into the oxide, but the latter is reconverted into carbide by the carbon of the crucible in which the substances are heated.

C. H. B.

Preparation of Strontium Sulphide by the Action of Hydrogen Sulphide on the Oxide or Carbonate. By José R. Mourelo (*Compt. rend.*, 1897, **125**, 775—777).—Strontium sulphide, SrS, is readily obtained as a white solid by the action of hydrogen sulphide on the red-hot oxide or carbonate, the latter, on the whole, giving the best results. Since the reaction is reversible, attention to the temperature and the rapidity of the current of gas is essential. If the conditions are such that the water formed can condense on the hot solid, the product contains some hydroxide. At a bright red heat, and with a slow current of gas, the product also contains strontium hydroxide, but with a sufficiently rapid current of gas, the conversion into sulphide is complete.

C. H. B.

Metallic Triple Nitrites. By Carl Przibylla (*Zeit. anorg. Chem.*, 1897, **15**, 419—446).—*Copper lead ammonium nitrite* $CuPb(NH_4)_2(NO_2)_6$, obtained by adding a solution of copper and lead nitrate to a solution of ammonium nitrate and sodium nitrite, is a black, crystalline salt having a bluish, metallic lustre; it is stable at the ordinary temperature or when gently warmed, and is very similar to the corresponding potassium salt. Like this salt, all the other triple nitrites contain $6NO_2$.

Copper calcium potassium nitrite, obtained by mixing a well-cooled solution of copper chloride and sodium nitrite with a solution of potassium chloride, calcium chloride, and sodium nitrite, is a deep green, crystalline powder, which is purified by washing with 85 per cent. alcohol and then with alcohol.

Copper calcium ammonium nitrite, prepared in a similar manner to the preceding salt but using very concentrated solutions, closely resembles the potassium salt, but if kept, gradually decomposes with evolution of nitrogen trioxide.

Copper barium potassium nitrite, obtained by mixing a well-cooled concentrated solution of barium chloride and sodium nitrite with a solution of copper chloride, potassium chloride, and sodium nitrite, is also a deep green, crystalline powder; it is stable when kept dry, but decomposes on recrystallisation, with evolution of nitrogen trioxide and the formation of basic salts.

Copper barium ammonium nitrite is very similar to the potassium salt, but slowly decomposes when allowed to remain at the ordinary temperature.

Copper strontium potassium nitrite, $CuSrK_2(NO_2)_6$, is obtained in a similar manner to the preceding salts, but a large excess of strontium chloride should be employed, as otherwise a mixture of salts is obtained containing less strontium; these cannot be purified by recrystallisation. The corresponding *ammonium* salt is very similar to the potassium salt.

Nickel lead potassium nitrite, obtained by mixing dilute solutions of potassium, lead, and nickel nitrate with a slight excess of sodium nitrite, is a heavy, brownish-yellow powder. The corresponding *ammonium* salt, which is a brownish-yellow powder, cannot be obtained pure. Salts containing nickel, barium, and ammonium nitrites, nickel, strontium, and ammonium nitrites and nickel, calcium and ammonium nitrites, are also described, but they are evidently mixtures.

Iron lead potassium nitrite is obtained on adding a solution of ferrous and lead nitrates to a solution of potassium nitrate and sodium nitrite as a heavy, reddish-yellow precipitate ; this, after being washed by decantation with water, and then on a filter with alcohol, is an intense orange-yellow powder, insoluble in cold water and stable at the ordinary temperature.

Iron barium potassium nitrite.—A bright yellow precipitate which is apparently a mixture of salts is obtained on mixing equivalent quantities of ferrous chloride, barium chloride, and potassium chloride with the necessary quantity of sodium nitrite ; by varying the proportions of the metallic salts, various mixtures of salts are obtained. A compound of the formula $FeBaK_2(NO_2)_6$ is obtained by mixing a solution of ferrous chloride [12·5 c.c. (1 c.c. = 0·1943 gram Fe)], potassium chloride (13 grams), and crystallised barium chloride (22 grams) in 120 c.c. of water with 100 c.c. of a solution of sodium nitrite (10 c.c. = 5 grams sodium nitrite); the precipitate is quickly separated by filtration, washed with alcohol, and dried at a gentle heat.

Iron calcium potassium nitrite and *iron strontium potassium nitrite.*—Yellow to reddish-yellow precipitates containing the three nitrites are obtained in a similar manner to the above salts; but they contain varying proportions of each nitrite according to the relative amounts of the constituents employed. The author was unable to obtain a compound to which a simple formula could be assigned. The corresponding ammonium salts of iron nitrite can be obtained in a similar manner by employing small quantities of the constituents for each experiment ; they are very similar to the potassium salts.

E. C. R.

Action of Hydracids and Oxygen on Mercury and other Metals. By MARCELLIN P. E. BERTHELOT (*Compt. rend.*, 1897, **125**, 746—749).—Hydrogen chloride may remain in contact with mercury at the ordinary temperature for many years without appreciable change. In sealed tubes, no reaction takes place below 500°. If, on the other hand, a mixture of dry hydrogen chloride (2 vols.) and oxygen (1 vol.) is allowed to remain in contact with mercury at about 20°, the hydrogen chloride gradually and completely disappears and the greater part of the oxygen is absorbed also, a mixture of mercurous chloride and oxychloride being formed. If mercurous chloride alone were formed, the reaction would develop + 87·6 Cal., but, nevertheless, the change takes place very slowly. Water does not prevent the reaction, but retards it to an extent depending on the proportion of water present. If hydrogen is added to the mixture of hydrogen chloride and oxygen, it remains unabsorbed, and the reaction with the mercury does not set up any reaction between the hydrogen and oxygen.

The action of hydrogen chloride and oxygen on mercury is analogous to the reactions observed with silver, lead, and copper.

When a mixture of hydrogen sulphide and oxygen is left in contact with mercury, the surface of the latter is slowly converted into sulphide, but the reaction does not continue unless the surface of the mercury is constantly renewed. The complete reaction would develop +74·8 Cal. C. H. B.

Action of Sulphuric Acid on Mercury at the Ordinary Temperature. By Marcellin P. E. Berthelot (*Compt. rend.*, 1897, **125**, 749—750).—When mercury is agitated with concentrated sulphuric acid at the ordinary temperature, the acid is partially reduced, and a mercury sulphate is formed which is precipitated as a basic salt when the acid is diluted with water. A minute quantity of black mercury sulphide is formed at the same time. The mercury used was very pure, and the same reactions were observed when the same quantity of mercury was subjected to three successive treatments with the acid. After prolonged contact between the acid and the mercury, the sulphate separates in yellowish crystals. A small quantity of water is sufficient to prevent the reaction; the acid $H_2SO_4 + H_2O$ does not attack mercury. C. H. B.

Cerium. By O. Boudouard (*Compt. rend.*, 1897, **125**, 772—774).—Experiments made with cerium acetate and sulphate tend to confirm Schützenberger's conclusion that cerium oxide free from thorium contains small quantities of an element of lower atomic weight. When the acetate is precipitated with hydrogen peroxide, the atomic weight of the element in the precipitate varies from 137·15 to 137·6, whilst the atomic weight of the element in the mother liquor varies between 137·85 and 139·9. C. H. B.

Manganimolybdates. By Arthur Rosenheim and Herrmann Itzig (*Zeit. anorg. Chem.*, 1898, **16**, 76—82).—The authors have prepared the complex salts described by Péchard (Abstr., 1897, ii, 498) to which he assigns the composition $3M'_2O,MnO_2,12MO_3$. They find that the ammonium salt described by Péchard is an *ammoninm potassium manganimolybdate* of the composition $2(NH_4)_2O,K_2O,Mn_2O_3,10MoO_3 + 5H_2O$. It is obtained by the action of potassium permanganate on ammonium manganimolybdate, and crystallises in dull-red, quadratic tablets; it is sparingly soluble in cold water, easily so in water at 70—80°, and decomposes when the solution is boiled, manganese dioxide being precipitated.

Potassium manganimolybdate, $3K_2O,MnO_2,8MoO_3 + 5H_2O$, is obtained by the action of potassium permanganate on a solution of potassium paramolybdate, by adding potassium chloride to a mixture of potassium permanganate and sodium paramolybdate, or by adding potassium chloride to a solution of the preceding ammonium salt; the second and third methods give very good yields. It crystallises in yellowish-red, quadratic tablets, and is almost insoluble in water.

The sodium salt, which is extremely soluble, cannot be prepared in a pure state, but crystallises mixed with manganous salts and alkali molybdates. The free acid was obtained as a black mass. Neither of the preparations were fit for analysis.

The authors especially draw attention to the remarkable decomposition of the above ammonium salt with potassium chloride, which takes place quantitatively when a solution of the ammonium salt is mixed with an excess of potassium chloride solution and allowed to remain 12 hours at the ordinary temperature. An examination of the filtrate from the precipitated potassium salt shows that this decomposition takes place according to the equation $2(NH_4)_2O,K_2O,Mn_2O_3,10MoO_3 + 4KCl = 3K_2O,MnO_2,8MoO_3 + 4NH_4Cl + MnO,2MoO_3$.

E. C. R.

Peruranic Acid and its Salts. By Petr G. Melikoff and L. Pissarjewsky (*Ber.*, 1897, **30**, 2902—2907).—Of the two formulæ for peruranic acid put forward by Fairley (this Journal, 1877, i, 127), Mendeléeff regards the expression UO_4 as the more probable, the salts being represented by the formulæ $(R_2O_2)_2UO_4$ and $R_2O_2(UO_4)_2$. The authors support this view, having found that, by means of aluminium hydroxide, peruranates may be resolved into metallic peroxides and UO_4, whilst carbonic anhydride, which has no influence on uranic acid, converts insoluble peruranates into metallic hydrogen carbonates, hydrogen peroxide, and free UO_4; moreover, salts have been obtained which have the formula $(RO)_2UO_4$.

The sodium salt, $(Na_2O_2)UO_4$, is a yellow, crystalline powder containing $8H_2O$; dilute sulphuric, hydrochloric, acetic, and succinic acids eliminate hydrogen peroxide, whilst continuous agitation of an aqueous solution of the salt with aluminium hydroxide resolves it into peruranic acid and hydrogen peroxide, a small quantity of sodium aluminate being also produced.

The *lithium* salt, $Li_2O_2(UO_4)_2$, is obtained by the action of lithium hydroxide and hydrogen peroxide on uranium nitrate, being precipitated from solution by alcohol; it crystallises in short, yellow prisms containing $8H_2O$. Its behaviour towards acids and aluminium hydroxide is similar to that of the sodium salt. The *lithium* salt, $(Li_2O_2)_2UO_4$, is very unstable; it is a red, crystalline substance, which gives off oxygen in the desiccator.

The ammonium salt, $(NH_4)_2O_2(UO_4)_2$, is a bright yellow, crystalline substance containing $8H_2O$; aluminium hydroxide eliminates hydrogen peroxide. The composition of this salt indicates the existence of ammonium peroxide (compare this vol., ii, 161), which is also rendered probable by the fact that ammonia behaves towards hydrogen peroxide in the same way as the fixed alkalis; moreover, tetrethylammonium hydroxide, when agitated with an ethereal solution of hydrogen peroxide, yields an oily liquid which gives rise to hydrogen peroxide under the influence of sulphuric acid, and decomposes spontaneously at common temperatures with liberation of oxygen.

The *barium* salt, $(BaO_2)_2UO_4$, obtained from the sodium salt and barium chloride, is an orange, crystalline powder, containing $8H_2O$, and yields hydrogen peroxide with sulphuric acid; repeated treatment with carbonic anhydride yields hydrogen peroxide, peruranic acid, and hydrogen barium carbonate. The *barium* salt, $BaO_2(UO_4)_2$, is prepared from the ammonium salt and barium chloride; it is a yellow, crystalline powder, containing $9H_2O$, and yields hydrogen peroxide when treated with sulphuric acid.

The *calcium* salt, $(CaO_2)_2UO_4$, prepared from the sodium salt and calcium chloride, crystallises in rhombic prisms, and contains $10H_2O$.

The *copper* salt, $(CuO_2)_2UO_4$, is obtained as a dark green, gelatinous precipitate on adding copper sulphate to a solution of the sodium salt.

The *nickel* salt, $(NiO)_2UO_4$, separates as a greenish-yellow, gelatinous precipitate on adding nickel sulphate to a solution of the sodium salt, hydrogen peroxide being found in the filtrate.

The *lead* salt $(PbO)_2UO_4 + PbO,UO_3$, a dark orange, crystalline powder, consisting of short prisms, is obtained from the sodium salt and lead acetate. Careful treatment with dilute acetic acid resolves it into lead acetate and peruranic acid without producing hydrogen peroxide.

Almost all the foregoing salts yield ozone when treated with concentrated sulphuric acid. Peroxides give rise to vigorous evolution of oxygen. M. O. F.

Action of Carbonic Oxide on Platinum and Palladium. By E. HARBECK and GEORG LUNGE (*Zeit. anorg. Chem.*, 1898, **16**, 50—66).—The method for estimating ethylene and benzene described in an earlier paper (this vol., ii, 193) is not applicable to coal-gas; this, the authors have discovered, is due to the presence of carbonic oxide, 2·6 per cent. of carbonic oxide being sufficient to prevent the action of platinum black on a mixture of ethylene and hydrogen. Moreover, if platinum black is saturated with carbonic oxide and the excess driven out with hydrogen, its action on a mixture of ethylene and hydrogen is destroyed.

Platinum black absorbs about 60 times its volume of carbonic oxide, and palladium black about 36 times its volume. The compound formed is probably a true chemical compound, since the carbonic oxide is not eliminated by the subsequent action of other gases, such as hydrogen; it is very stable, but suddenly decomposes at 250° into its constituents. The authors were unable to isolate it, as it is not volatile, and cannot be extracted by the ordinary solvents. E. C. R.

Platinum Tellurides. By CARL ROESSLER (*Zeit. anorg. Chem.*, 1897, **15**, 405—411).—*Platinum ditelluride*, $PtTe_2$, is obtained by heating an intimate mixture of finely divided platinum with a slight excess of tellurium, and extracting the product with concentrated potassium hydroxide (1 water : 2 alkali) as long as tellurium dissolves. It is a grey, crystalline powder, but may be obtained in octahedra by dissolving platinum in ten times the theoretical quantity of tellurium under borax, allowing the fused mass to cool slowly, and then extracting it with cold dilute nitric acid. It is only slowly attacked by boiling concentrated nitric acid, and is not altered by boiling with concentrated potassium hydroxide, but if a rod of zinc is placed in the solution, potassium telluride is at once formed. When protected from the air, it does not melt below the boiling point of tellurium, but if heated in the blowpipe flame, it melts to a pasty mass, which gradually loses tellurium, becomes limpid, and finally leaves a residue of platinum.

Platinum telluride, PtTe, is prepared by heating the ditelluride in the blowpipe flame until it becomes limpid, and allowing it to cool, when it crystallises out in polyhedra; good crystals may also be obtained by heating an intimate mixture of tellurium (100 grams) and platinum (150 grams) in a glass tube until combination takes place, then melting the mixture together with the glass, and dropping the hot glass into cold water. When the monotelluride is heated in the blowpipe flame for a short time, a compound is obtained which, on analysis, gives numbers approximating to those required by the formula Pt_2Te. The regulus thus obtained has a dull grey, crystalline fracture.

In analysing the above compounds, the finely powdered sample, after being fused in a platinum crucible with 10 times the quantity of a mixture of potassium nitrate (1 part) and sodium carbonate (2 parts), is extracted with water and the platinum filtered off. The solution is evaporated to dryness with hydrochloric acid, the residue dissolved in water, and the tellurium precipitated with sulphurous acid.

E. C. R.

Mineralogical Chemistry.

Copper Ore from Argentina. By JUAN VALENTIN (*Anal. Museo Nac. Buenos Aires*, 1897, 5, 28—32).—The copper ore described occurs in the Chacabuco mine, dept. Iruya, prov. Salta, along with copper pyrites, tetrahedrite, pyrites and blende in a gangue of quartz, calcite, and dolomite. It is massive with a sub-conchoidal fracture; and the colour is grey with a reddish tinge which, on exposure to the air, becomes bluish. H = 3; sp. gr. = 5·18—5·28. It is soluble in hydrochloric acid with evolution of hydrogen sulphide. Analysis by Kyle gave

Cu.	Fe.	Ag.	S.	$CaCO_3$.	$MgCO_3$.	Insol.	Total.
71·00	3·85	0·18	20·71	1·96	1·13	0·80	99·63.

After deducting gangue, this is interpreted as a mixture of 75·25 per cent. of copper glance (Cu_2S) and 24·56 of erubescite (Cu_3FeS_3).

L. J. S.

Cinnabar and Onofrite from Ouen-Shan-Tchiang, China. By PIERRE TERMIER (*Bull. soc. fran. min.*, 1897, 20, 204—210).—In the cinnabar mines of Ouen-Shan-Tchiang, in the province Koueï-Tchéou, Central China, the ore occurs in quartzose veins in limestone. Onofrite is present in small patches; the fracture is granular and shining and iron-black. Analyses by Pisani gave I for the cinnabar and II for the onofrite; the second agrees with the formula (Hg,Zn)(S,Se).

	Hg.	S.	Se.	Zn, (trace of Fe).	Total.
I.	85·75	13·70	Nil	—	99·45
II.	77·3	10·3	8·4	1·3	97·3

A small quantity of onofrite, quite free from specks of enclosed cinnabar, gave 9·4 per cent. of sulphur.

The cinnabar sometimes occurs in large crystals. Interpenetrating twin crystals are described, which, in polarised light, are seen to consist of intimately intergrown right and left optically rotating individuals, the combination sometimes showing Airy's spirals. These compound crystals possess hexagonal symmetry. L. J. S.

Bauxite Deposits of Arkansas. By JOHN C. BRANNER (*J. of Geology*, 1897, **5**, 263—289).—The occurrence, mining, &c., of bauxite in Arkansas are described; it is usually pisolitic, but sometimes massive in structure, and occurs in connection with syenite. Several analyses are given, the extremes are

H_2O.	Al_2O_3.	SiO_2.	Fe_2O_3.	TiO_2.
30·31—17·39	62·05—37·60	2·00—45·20	1·37—22·15	0—3·50

As shown by the extremes given to the right, it graduates into pisolitic kaolin. Some varieties are highly ferruginous, containing 54·9—66·85 per cent. of ferric oxide, but those which are the deepest in colour do not always contain the most iron. The various views as to the origin of bauxite are discussed, and its uses as a refractory material described. A complete bibliography is added. L. J. S.

Ankerite from Sandhurst, Victoria. By THOMAS COOKSEY (*Records Australian Museum*, 1897, **3**, 63—65).—Ankerite occurs as lenticular crystals, associated with quartz, albite, and chalybite, at Sandhurst, Victoria. The surfaces of the flat rhombohedra have a yellowish tinge, but in the interior they are colourless and translucent. Analyses gave, after deducting some albite,

$CaCO_3$.	$FeCO_3$.	$MgCO_3$.	Mn.	Sp. gr.
50·76	23·97	25·93	Nil.	2·994.

This gives the formula $5CaCO_3,2FeCO_3,3MgCO_3$. In Boricky's general formula, $CaFeC_2O_6 + nCaMgC_2O_6$, the value of n is here 3,2. L. J. S.

Langbeinite, a Tetartohedral Cubic Mineral. By OTTO LUEDECKE (*Zeit. Kryst. Min.*, 1898, **29**, 255—261.)—The double salt, $K_2SO_4,2MgSO_4$, prepared artifically by Precht (*Chem. Indust.*, 1880, **3**, 418) and first described as a mineral by Zuckschwerdt (*Zeit. angew. Chem.*, 1891, 356) has been found in considerable quantities at several localities (Westeregeln, Wilhelmshall, Neu-Stassfurt, Solvayhall, &c.) in the Prussian salt deposits. The mineral has a glassy lustre and a conchoidal fracture; H = 3—4; sp. gr. = 2·83. It is slowly decomposed by water, and attracts moisture from the air. Analyses by Zuckschwerdt of grey and white material gave I and II respectively; III, by Wagner, is of transparent material.

	K_2SO_4.	$MgSO_4$.	$CaSO_4$.	$MgCl_2$.	MgO.	NaCl.	H_2O.	Sp. gr.
I.	41·30	58·20	—	0·22	0·08	—	—	2·86
II.	38·99	58·55	0·50	0·55	0·13	0·43	0·78	
III.	41·0	58·1	—	—	—	—	1·0	2·81

The cubic crystals are very rare; they are of interest in being tetartohedral (tetrahedral-pentagonaldodecahedral class of Groth). One crystal shows the forms, {100}, {111}, $\{1\bar{1}1\}$, $\{2\bar{1}1\}$, $\{2\bar{2}1\}$, {310}, {210}, {920} and {110}; the arrangement of the faces is as on the crystals of sodium chlorate which rotate the plane of polarisation to the left. The crystals of langbeinite are optically inactive; index of refraction for sodium light, 1·5281; for thallium light. 1·5343.

L. J. S.

Planoferrite. By L. Darapsky (*Zeit. Kryst. Min.*, 1898, **29**, 213—216).—The name planoferrite is given to a new hydrated basic ferric sulphate occurring with copiapite, coquimbite, and other sulphates in the "Lautaro" copper mine at Morro Moreno, near Antofagasta, Chili. The small tabular crystals are determined by F. Grünling to be probably orthorhombic; they are yellowish-green to brown in colour, and have a perfect cleavage parallel to the large plane. Water easily decomposes the mineral with separation of basic ferric sulphate. Analysis gave

Fe_2O_3.	SO_3.	H_2O.	Insol.	Total.
31·20	15·57	51·82	1·41	100·00

corresponding with $Fe_2O_3,SO_3,15H_2O$. This is more basic than amarantite, and contains more water than other basic ferric sulphates. It may have been formed by the alteration of copiapite.

Analyses are also given of material from the salt deposits near Taltal, Chili, consisting of mixtures of glauberite, blödite, soda nitre, and rock salt.

L. J. S.

Beresowite, a New Mineral. By J. Samoiloff (*Bull. Soc. Imp. des Naturalistes Moscow*, 1897, 290—291).—Beresowite occurs with galena and cerussite at Beresowsk in the Urals. The indistinct tabular crystals are dark red, and resemble melanochroite; they have a perfect cleavage in one direction and are pleochroic; sp. gr. = 6·69. Pseudomorphs of beresowite after crocoite are also found. Analysis gave results agreeing with the formula $2PbO,3PbCrO_4,PbCO_3$.

PbO.	CrO_3.	CO_2.	Total.
79·30	17·93	2·46	99·69

L. J. S.

Gedrite-schist from Dalecarlia. By Mats Weibull (*Jahrb. f. Min.*, 1897, ii, Ref. 443—445; from *Geol. För. i Stockholm Förh.*, 1896, **18**, 377).—Amongst the quartz-hornblende-schists occurring in the mining district of Vester-Silfberg, in southern Dalecarlia, is a variety containing the orthorhombic aluminous amphibole, gedrite. Besides much quartz and bundles of gedrite, this contains some orthoclase, magnetite, apatite, and albite. The gedrite individuals are 2—3 cm. long and 0·5 mm. thick. Detailed optical determinations are given; the pleochroism is strong. Gedrite of sp. gr. = 3·243 gave, on analysis by J. Petrén,

SiO_2.	Al_2O_3.	FeO.	MnO.	MgO.	Na_2O.	K_2O.	H_2O.	Total.
47·40	13·68	23·38	2·36	7·32	3·21	trace	1·97	99·32

Formula: $10R''SiO_3 + 2R''Al_2SiO_6 + R'Al(SiO_3)_2$, where $R' = H + Na$, and $(Fe + Mn) : Mg : H_2 : Na_2 = 6 : 3 : 2 : 1$.

The mineral, in containing alkali, approaches to glaucophane in composition. L. J. S.

Hornblende-Basalt from Mitlechtern. By K. von Kraatz-Koschlau (*Jahrb. f. Min.*, 1897, ii, Ref., 475—476; from *Notizbl. Ver. f. Erdkunde Darmstadt*, 1896, [iv], 17, 23—28).—Hornblende-nepheline-basalt from the central portion of a dyke, 6—8 m. thick, gave analysis I; towards the margins of the dyke, iron ore becomes more plentiful, and hornblende and nepheline are replaced by biotite and plagioclase respectively. Anal. II is of the hornblende-granite which is cut by the basalt dyke; it contains orthoclase, plagioclase, biotite, hornblende, and titanite. Altered granite from near the basalt-contact gave anal. III. The high percentage of water in I and III is considered to represent the water originally contained in the basaltic magma.

	SiO_2.	TiO_2.	Al_2O_3.	Fe_2O_3.	FeO.	MnO.	MgO.	CaO.	Na_2O.	K_2O.	H_2O.	Total.
I.	40·19	not det.	11·91	6·24	6·63	trace	12·67	13·18	2·90	2·34	4·19	100·20
II.	61·33	,,	16·12	3·34	3·00	,,	5·73	5·45	2·32	3·27	0·85	101·41
III.	58·44	,,	16·77	3·67	2·75	,,	4·63	4·64	2·62	4·35	3·02	100·89

L. J. S.

The Monchiquites or Analcite Group of Igneous Rocks. By Louis V. Pirsson (*J. of Geology*, 1896, 4, 678—690).—That a basic rock like monchiquite, occurring in deep-seated dykes, should contain so much glass is rather anomalous. Hunter's analysis of the so-called glassy base of the original Brazilian monchiquites (Abstr., 1892, 1058) gives the molecular ratios, $SiO_2 : Al_2O_3 : Na_2O : H_2O = 4 : 1 : 1 : 2$, as in analcite. This glassy base has, then, the exact chemical composition, the exact specific gravity, the property of gelatinising with acids, and the optical properties of analcite; it must therefore be that mineral, and not a pitchstone glass as was formerly supposed.

This analcite is of primary origin, as in the analcite-basalt from Montana described by Lindgren (Abstr., 1892, 1413), and as there is a leucite group of rocks, so is there an analcite group. The analcite-basalts corresponding with the leucite-basalts are the monchiquites of Rosenbusch, and the analcitites, or olivine-free analcite-basalts, are the fourchites of J. F. Williams. L. J. S.

Analcite-basalt from Colorado. By Whitman Cross (*J. of Geology*, 1897, 5, 684—693. Compare preceding abstract).—A black basaltic rock occurs, presumably as a dyke, at "The Basin," west of Cripple Creek, in Colorado. Besides phenocrysts of augite, olivine, and analcite, there are also present felspars, magnetite, biotite, and apatite. The analcite, which occurs as white isotropic grains, gave analysis I; the silica is somewhat low, but there is no reason for doubting the reference to analcite. The portion of the rock soluble in hydrochloric acid has practically the same composition. The pale yellow augite gave the results under II. The bulk analysis of the rock is given under III. The analyses are by W. F. Hillebrand.

	SiO_2.	ZrO_2.	TiO_2.	Al_2O_3.	Fe_2O_3.	FeO.	MnO.	CaO.	SrO.	BaO.
I.	51·24	—	—	24·00	1·20	—	—	1·62	0·06	—
II.	49·26	—	1·53	6·01	3·31	4·23	—	21·79	0·06	—
III.	45·59	0·03	1·32	12·98	4·97	4·70	0·14	11·09	0·12	0·13

	MgO.	K_2O.	Na_2O.	Li_2O.	H_2O. (over H_2SO_4).	H_2O. (remainder).	SO_3.	Cl.	P_2O_5.	Total.
I.	0·33	1·25	11·61	—	0·62	8·47	Nil	trace	—	100·40
II.	12·40	0·41	0·79	—	—	—	—	—	—	99·79
III.	8·36	1·04	4·53	trace	0·51	3·40	—	0·05	0·91	99·87

The plagioclase-basalts of the same region have the same composition but with less water, the presence of which has influenced the formation of analcite. L. J. S.

Contact Metamorphism of Phyllites. By K. DALMER (*Jahrb. f. Min.*, 1897, ii, 215—218. Compare this vol., ii, 82).—The green mineral of phyllites, which is decomposed by hydrochloric acid, is considered to be probably thuringite. This consists, according to Rammelsberg, of mixtures, in varying proportions, of $2(Al,Fe)_2O_3,SiO_2$ and $2(Fe,Mg)O,SiO_2$ with water; and, after deducting muscovite, the results of some analyses are made to agree with this formula. According to Tschermak, biotite also contains the olivine molecule $2(Fe,Mg)O,SiO_2$.

These formulæ are used in an equation (which is a modification of that given in the previous paper) to express the change from a phyllite, consisting of muscovite, quartz, and thuringite, to a rock containing biotite and andalusite. Cordierite could also be produced from a mixture of muscovite, quartz, and thuringite. L. J. S.

Average Specific Gravity of Meteorites. By OLIVER C. FARRINGTON (*J. of Geology*, 1897, 5, 126—130).—From the weights and specific gravities of 142 meteorites of which the fall has been recorded during the last hundred years, the average specific gravity of meteoric matter is deduced as being 3·69. L. J. S.

Meteoric Iron from Beaconsfield, Australia. By EMIL W. COHEN (*Sitz.-ber. Akad. Berlin*, 1897, 1035—1050).—This iron, which has recently been found near Beaconsfield, Mornington Co., Victoria, originally measured 30 × 30 × 15 cm., and after a portion of the thick coating of rust had been removed, it weighed 75 kilos.; it exudes much ferrous chloride, and is consequently liable to rapid alteration. It is an octahedral iron of coarse structure with kamacite predominating. Crystals of schreibersite gave analysis I, agreeing with the ratio $(Fe,Ni,Co):P = 3·1585:1$. Fine needles of rhabdite gave II, here $(Fe,Ni,Co):P = 3·0533:1$. The tænite gave III after deducting some nickel-iron phosphide. Indistinct crystals of cohenite are of irregular distribution in the iron; after deducting a little schreibersite, which closely resembles cohenite in physical characters, it gave the results under IV; $(Fe,Ni,Co):C = 3·064:1$. Nodules of troilite gave V;

(Fe,Ni,Co) : S = 1 : 0·9901. Graphite, carbonaceous matter, and silicate grains are also present. The bulk analysis of the iron gave VI; this corresponds with 98·07 per cent. of nickel-iron.

	Fe.	Ni.	Co.	Cu.	C.	P.	S.	Cl.	Total.	Sp. gr.
I.	66·92	18·16	0·62	—	—	14·88	—	—	100·58	7·17
II.	[41·54]	42·61	[0·80]	—	—	15·05	—	—	100·00	—
III.	[50·92]	47·98	0·63	—	0·47	—	—	—	100·00	7·1297
IV.	90·94	2·22	0·30	—	6·54	—	—	—	100·00	7·2014
V.	58·07	4·34	1·52	—	—	trace	36·07	trace	100·00	4·7379
VI.	92·56	7·34	0·48	0·02	0·05	0·26	0·04	0·01	100·76	—

In the rust is a substance with the characters of stilpnosiderite (limonite); it contains a little nickel and cobalt. This iron is possibly part of the same fall as the Cranbourne iron (Abstr., 1883, 169).

L. J. S.

The Nocoleche Meteorite. By Thomas Cooksey (*Records Australian Museum*, 1897, 3, 51—62).—This iron, which was found in 1895 near Nocoleche Station, Wanaaring, N.S. Wales, weighed 20,048 grams, and measured 12¾ × 11½ × 5½ cm. It is an octahedral iron with broad bands of kamacite. The mean of four partial analyses of material visibly free from troilite is given under I, sp. gr. = 7·721, 7·796.

	Fe.	Ni.	Co.	Cu.	P.	S.	Residue.	Total.
I.	96·93	2·91	0·21	0·05	0·12	0·11	0·08	100·41
II.	62·01	0·89		—	—	38·28	trace	101·18

Troilite nodules are freely distributed; sp. gr. = 5·50, 5·442. After extracting, by the prolonged action of a solution of mercuric chloride, 34·6 per cent. of intimately intermixed metallic iron, the troilite gave analysis II; sp. gr. = 4·645.

A catalogue and bibliography of all the known Australian meteorites is added.

L. J. S.

The Fisher Meteorite. By Newton H. Winchell (*Amer. Geologist*, 1897, **20**, 316—318).—This stone fell on April 9th, 1894, at Fisher, Polk Co., Minnesota; the smaller of the two fragments weighs about 9½ pounds (*ibid.*, 1894, **14**, 389). It consists mainly of olivine and enstatite with occasionally chrondritic structure; there are specks of metallic iron and troilite; and glassy matter, asmanite (tridymite), and maskelynite are also perhaps present (*ibid.*, 1896, **17**, 173, 234; and *Compt. rend.*, 1896, **122**, 681). In the present paper, the somewhat slender evidence for the presence of maskelynite is recapitulated. Analysis of the meteorite by C. P. Berkey gave:

SiO_2.	Al_2O_3.	Fe.	MgO.	CaO.	Ni.	S.	Total.	Sp. gr.
41·16	6·60	24·26	19·03	4·34	2·26	trace	97·65	3·44

The iron shown above exists in the native state and also as silicate, oxide, and sulphide.

L. J. S.

Physiological Chemistry.

Active Absorption of Oxygen by the Lungs. By J. LORRAIN SMITH (*J. Physiol.*, 1898, **22**, 307—318).—Various pathological conditions (fever, toxic agents of bacterial origin, local changes in the lung produced by high pressure oxygen) interfere with the active absorption of oxygen by the pulmonary epithelium, and reduce the oxygen tension of the arterial blood to about that of the alveolar air.

W. D. H.

Effect of Division of the Food into Several Meals on Proteid Katabolism. By OTTO KRUMMACHER (*Zeit. Biol.*, 1897, **35**, 481—505).—The research was carried out for prolonged periods, and numerous observations were made during that time. There is an increase in the discharge of nitrogen if the day's food is given in one large meal; estimation of the ethereal hydrogen sulphates in the urine shows, however, that the difference is due to variations in the putrefaction of proteid in the intestines, and not to an alteration in true metabolic processes.

W. D. H.

The Action of Superheated Water on Proteids. By ERNST L. SALKOWSKI (*Zeit. Biol.*, 1897, **34**, *Jubelband*, 190—245).—Muscle and fibrin were employed, the latter being more soluble in superheated water than muscle, of which, as a rule, more than half is left undissolved. The atmid-albumoses so formed are described, and points of difference from Neumeister noted. Feeding experiments with the product are given, but are at present incomplete, the principal point made out being that much proteid matter is unused, the presence of the atmid-products apparently stimulating putrefactive processes in the intestine.

W. D. H.

Physiology of the Salmon in Fresh Water. By D. NOËL PATON, FRANCIS D. BOYD, JAMES C. DUNLOP, A. LOCKHART GILLESPIE, G. LOVELL GULLAND, E. D. W. GREIG, and M. I. NEWBIGIN (*J. Physiol.*, 1898, **22**, 333—356).—Salmon apparently do not feed while in fresh water; this is shown by an examination of the alimentary tract, and by the low proteolytic activity of its glands; there is increase in the putrefactive organisms, which is probably due to the diminished activity of the stomach contents.

The metabolism in the salmon under these circumstances was studied by observations on the changes in the solids of muscles, ovaries and testes, and in the fats and proteids of these and other organs. The observations are histological and chemical, and numerous analytical details are given. The proteids in muscle described are paramyosinogen, myosinogen, myoglobulin, and a small amount of nucleo-proteid. Some of the proteid is not soluble in saline solution, but is soluble in 1 per cent. sodium hydroxide. The soluble proteids diminish in the upper waters of the river.

If from the fat and proteid lost from the muscles the amount going to the ovaries and testes be subtracted, the residue gives the amounts available for the liberation of energy. Up to August, the ratio of the energy from proteids to that from fats is 1 : 4·2, and to November, the proportion is 1 : 7·6 in female fish; up to August, 1 : 11·6 in male fish. With regard to phosphorus, the results indicate that the phosphorus stored in the muscles as phosphates is transferred to the generative organs and is there built up into organic combinations. In both ovary and testes, lecithin is an important step in this conversion, and in the ovary, ichthulin, a pseudo-nuclein, is an intermediate step to the true nucleins; this stage is absent in the testes.

The increase of iron in the ovaries is not derived from muscle, but from the hæmoglobin of the blood.

The colour of salmon flesh and ovary is due to two lipochromes, yellow and red. The yellow pigment is probably derived from the herring, &c., on which the salmon feeds, whilst the red pigment is possibly formed from the yellow; as the season advances, the red pigment disappears from the muscles and accumulates in the ovaries.

W. D. H.

Applications of Dialysis to certain Questions in Chemical Physiology. By Maurice Arthus (*Zeit. Biol.*, 1897, **34**, *Jubelband* 432—446).—The method of dialysis is regarded as a valuable one, and its use is described in connection with the questions of the importance of calcium salts in blood coagulation, of the state of sugar in the blood, and in the preparation of oxyhæmoglobin crystals. In connection with the first of these points, new experiments are described which confirm the author's previous work, and are opposed to the views of A. Schmidt. The sugar of the blood behaves as if it were free there; glycolysis can be avoided by a low temperature or by the addition of 1 per cent. of sodium fluoride.

The addition of alcohol to an aqueous solution of oxyhæmoglobin causes crystallisation of this substance. This method may be most successfully carried out by placing the solution in a dialyser plunged in dilute alcohol. W. D. H.

Non-coagulable Proteids of Muscle. By Karl Mays (*Zeit. Biol.*, 1897, **34**, *Jubelband*, 268—297).—The research relates to the presence in muscle of proteid material which is not coagulated by heat. Opinions are divided on the question as to whether fresh muscle contains proteoses; the present work shows that there is some proteid material which is not coagulated by heat. A considerable section of the paper is devoted to the occurrence of nucleon (phosphorcarnic acid) in muscle and in meat extracts, Siegfried's statements being, on the whole, confirmed; this substance, however, is completely precipitated by saturation with ammonium sulphate, and cannot therefore be classed with the peptones. W. D. H.

A Method of Freeing Flesh from Fat. By Otto Frank (*Zeit. Biol.*, 1897, **35**, 549—554).—The objection to Dormeyer's digestion method of obtaining the fat from muscle is that the lecithin undergoes decomposition, and the proteid material is so changed that further investigation of it is impossible.

The present research shows that an almost complete extraction of

the fat from finely divided flesh can be accomplished by extraction with 96 per cent. alcohol followed by extraction with ether for 24 hours in a Soxhlet extractor. (Compare Bogdanow, this vol., ii, 84.)
W. D. H.

Extraction of Fat. By Erwin Voit [and Otto Krummacher] (*Zeit. Biol.*, 1897, **35**, 555—582).—This, like Frank's researches (preceding abstract), is work which shows that Dormeyer's method has many disadvantages. If small quantities of material as free from water as possible are taken, and the extraction with ether properly carried out, all the fat can be generally obtained in the extract; certainly 95 per cent. of the fat is always removed. Some sources of error, however, in the extraction have still to be explained.
W. D. H.

Composition of Human Milk. By Alfred H. Carter and H. Droop Richmond (*Brit. Med. J.*, 1898, i, 199—203).—A large number of analyses are given. The proteids, ash, and sugar decrease as lactation advances, the composition of the fat (as indicated by the refractive index) also varies, the amount of the volatile acids increasing as lactation proceeds.

Milks which disagree with infants are generally those in the early stage; probably here the normal functions of the breast are delayed and the colostrum period prolonged. W. D. H.

Relations between the Growth of the Offspring and the Composition of the Milk in various Mammals. By Fr. Pröscher (*Zeit. physiol. Chem.*, 1897, **24**, 285—302).—The variations in the composition of the milk in different animals suggests that this is explicable, from the teleological standpoint, on the different stages at which birth takes place, some constituents being more suitable at certain stages of growth than others. This is confirmed by comparing the most trustworthy of the analyses of milk hitherto published. The difference in the needs of the suckling offspring and the adult may be thus summarised: the infant needs more proteid for tissue formation, more fat for heat production because it has a relatively large surface area, and less carbohydrate because it does less work. W. D. H.

Secretion of the so-called Salivary Glands of Octopus macropus. By Ida H. Hyde (*Zeit. Biol.*, 1897, **35**, 459—477).—The secretion obtained by electrical stimulation contains proteid, but mucin is absent; the action of the juice is not described.
W. D. H.

The Excretion of Ammonia and Ammonium Salts by the Human and Animal Body. By Theodor Rumpf, and G. Kleine (*Zeit. Biol.*, 1897, **34**, *Jubelband*, 65—124).—Large doses of organic ammonium salts are not oxidised in the body, but increase the excretion of ammonia; with ammonium formate, the volatile acids of the urine are also increased. The ammonia leaves the body mostly as chloride, less as the sulphate, and least as the phosphate. The increase in the acid components is, however, greater than that of the ammonia. The excretion of urea is lessened.

Of the salts used, ammonium carbonate is most easily oxidised; formate, acetate, and citrate follow in the order named.

Sodium phosphate and calcium carbonate cause a small decrease in the excretion of ammonia, but magnesium phosphate has no effect. The alkali salts of organic acids lessen the ammonia considerably. The inorganic ammonium salts undergo decomposition into organic combinations, which increase the alkalinity of the blood, and, in the case of ammonium carbonate, powerful toxic effects are observed; it is probable that this organic compound is ammonium albuminate.

W. D. H.

Action of Distilled Water on Tubifex. By SYDNEY RINGER (*Proc. physiol. Soc.*, 1897—8, 14. Compare Abstr., 1895, ii, 39).—The experiments recorded confirm Locke's conclusion that copper in even infinitesimal quantities will disintegrate *Tubifex*, whilst water free from copper and other heavy metals, and without any salts, such as calcium salts, can sustain the life of the animal. W. D. H.

Physiological Action and Chemical Constitution of Piperidine, Coniine, and Nicotine. By B. MOORE and R. ROW (*J. Physiol.*, 1898, **22**, 273—295).—The alkaloids mentioned are similar in physiological action, and they all contain a reduced pyridine (or pyrroline) ring. Intensification of the action is due to the introduction of an organic radicle as a side group.

Motor paralysis (in frogs) is due to an effect on the intramuscular part of the motor nerves; the excised heart is slowed and the systole prolonged. The heart *in situ* in mammals is at first slowed. The arterial blood-pressure is raised, owing to constriction of the arterioles, this being probably due to vaso-motor excitation in peripheral ganglia; at a certain stage, this mechanism is paralysed, further administration of the drugs no longer affecting blood-pressure. W. D. H.

Physiological Effects of Extracts of Supra-renal Capsules. By SWALE VINCENT (*J. Physiol.*, 1898, **22**, 270—272. Compare Abstr., 1897, ii, 420, 573).—In dogs and cats, subcutaneous injection of large doses of extracts of supra-renal capsules is fatal, the symptoms observed being similar to those already described in other animals. With the possible exception of the thyroid, the supra-renal appears to be the only mammalian tissue or organ which produces toxic effects when a boiled and filtered extract is administered subcutaneously.

W. D. H.

The Biuret Reaction in Human Urine. By H. BAREND J. STOKVIS (*Zeit. Biol.*, 1897, **34**, *Jubelband*, 466—470).—In cases where peptonuria is suspected, the positive results of the biuret reaction, and of precipitation by phosphotungstic acid or ammonium sulphate cannot be depended on in the presence of urobilin, which responds to all these reactions. W. D. H.

Chemistry of Vegetable Physiology and Agriculture.

Fermentation Phenomena. By ALFRED STAVENHAGEN (*Ber.*, 1897, **30**, 2963).—A reply to Buchner and Rapp (this vol., ii, 127). The author states that his extract was capable of fermenting before it was filtered, and also points out that he used a Kitasato filter, and not a Chamberland. J. J. S.

Zymase. By RICHARD NEUMEISTER (*Ber.*, 1897, **30**, 2963—2966. Compare Buchner, Abstr., 1897, ii, 154, 380; this vol., ii, 127).—The author considers that the active principle of Buchner's extract is not an enzyme (zymase), but is more probably a mixture of complex proteids whose interactions bring about the fermentation. The author compares Buchner's results with those obtained by Kühne with extract of frog's muscles. Buchner's view of the existence of two enzymes in the same cell, one of which can completely destroy the other, is held to be untenable. J. J. S.

Alcoholic Fermentation without the aid of Living Yeast Cells. By MARIE VON MANASSEÏN (*Ber.*, 1897, **30**, 3061—3062. Compare Buchner, Abstr., 1897, ii, 154, 380; Stavenagen, this vol., ii, 88, and Neumeister, preceding abstract).—The author states that, as early as 1871, she pointed out that living yeast cells are not necessary for alcoholic fermentation, and that the fermentation is to be regarded as a chemical process brought about by an enzyme formed in the yeast. J. J. S.

Denitrification. By G. AMPOLA and E. GARINO (*Gazzetta*, 1897, **27**, ii, 197—206).—It is shown that a denitrifying organism isolated by the authors, the *Bacterium denitrificans agilis*, when cultivated at 35—36° in nitrated broth, causes the evolution of nitrogen containing 15 per cent. of carbonic anhydride. W. J. P.

Maturation of Fruits. By MAXIMILIEN GERBER (*Ann. Agron.*, 1897, **23**, 606—607; from *Ann. Sci. Nat.*, [viii], *Botan.*, **4**, 1).—When fruits containing malic, citric, or tartaric acid, such as apples, pippins, or grapes, are kept at 30°, the respiratory quotient, CO_2/O_2, which is at first more than 1, decreases until it becomes 1 or even less. It is concluded that the acids are progressively consumed with liberation of carbonic anhydride; a carbohydrate is, at the same time, formed. When *Sterigmatocystis Nigra* is cultivated in Raulin's liquid, containing malic, citric or tartaric acid instead of saccharose, the carbohydrate, callose, is produced under the form of the mycelium, and the respiratory quotient is high.

In the case of fruits containing tannin, the respiratory quotient is below 1, whilst *S. Nigra* cultivated in Raulin's liquid (with tannin as the only source of carbon) produces carbohydrates, and has a respiratory quotient higher than 1. With fruits, the tannin is probably destroyed without production of carbohydrates; ethers are then formed, producing a higher respiratory quotient. It is suggested that at this period the insoluble pectose of the cell-wall is transformed into soluble pectin, causing respiration to be obstructed, with the result that the fruit is forced to depend on the fermentation of its saccharine matter to enable it to obtain the necessary energy to live. The fermentation resembles those observed by Lechartier and Bellamy in fruits in a confined atmosphere.

The original paper contains a very complete bibliography on the subject of the maturation of fruits. N. H. J. M.

Composition of the Mycelia of Moulds. By MARSCHALL (*Chem. Centr.*, 1897, i, 115—116; from *Arch. Hyg.*, **28**, 16—29).—Cultures of *Aspergillus niger*, *Penicillium glaucum*, and *Mucor Stolonifer* were made in peptone-meat extract containing 1 per cent. of tartaric acid and 2 per cent. of dextrose; the albuminous and non-albuminous nitrogenous substances were separated by ferric acetate. Taking the mean, it was found that the mycelia of these moulds contain 38 per cent. of albumin, 5·27 of substances soluble in ether, 14·03 of substances soluble in alcohol, 6·37 of ash, 5·03 of cellulose, 2·80 of starch, and 28·47 of nitrogenous substances soluble in water. Bacteria, even when cultivated in material rich in sugar, contain more nitrogenous substances than the moulds, but at the most only traces of cellulose and starch. The spores of the moulds contain twice as much cellulose, starch, and substances soluble in alcohol as the mycelia, but are poorer in albumin. As regards composition, the moulds occupy a position intermediate between fungi and bacteria; they are richer in nitrogen than the former, but poorer in carbohydrates. E. W. W.

Influence of Oxygen and other Substances on the Formation of Chlorophyll. By WLADIMIR PALLADIN (*Compt. rend.*, 1897, **125**, 827—829.)—Etiolated leaves, almost free from carbohydrates, were floated on recently boiled water and on aqueous solutions of various substances and exposed to light, the formation of chlorophyll being noted. Certain substances, such as saccharose, raffinose, dextrose, levulose, maltose, glycerol, galactose, lactose, and dextrin assist in the production of chlorophyll, whilst others, such as inulin and tyrosin, have no action, and a third group, including mannitol, dulcitol, asparagine, carbamide, alcohol, ammonium chloride, and quinic acid retard or prevent its formation. If one of the leaves falls to the bottom of the liquid, no chlorophyll is formed in it. Direct experiments showed that the formation of the chlorophyll in etiolated leaves only takes place when oxygen is present, and the author concludes that it is essential to the production of the chlorophyll that the vegetable tissues receive more oxygen than is necessary for their respiration. C. H. B.

Vegetable Lecithin. By ERNST SCHULZE (*Chem. Zeit.*, 1897, **21**, 374—376).—This paper is merely a *résumé* of work previously published, both by the author and others. (Compare Abstr., 1891, 413, 489, and 511; 1894, ii, 155 and 402; 1895, ii, 96). A method is given for the estimation of the amount of lecithin present in different vegetable tissues, depending on the estimation of phosphorus in the ethereal and alcoholic extracts. The author points out that the method is not very accurate, since different lecithins (dipalmityllecithin, distearyllecithin and dioleyllecithin) contain different percentages of phosphorus. The amounts of lecithin usually present in different seeds are given, and also the distribution of the lecithin within the seed. Attention is also drawn to the relationship between lecithin and chlorophyll. The author states that, in giving the amount of fatty material in foods (oil cakes, &c.), the lecithin should always be included, as on digestion it becomes converted into fatty acids, choline, and glycerophosphoric acid. J. J. S.

Formation of Albumin in Phanerogamic Plants. By Barthold Hansteen (*Chem. Centr.*, 1897, i, 295; from *Ber. Deut. bot. Ges.*, **14**, 362—371).—Kinoshita studied the formation of albumin from asparagine in leguminous plants by allowing young roots, from which the cotyledons had been removed, to grow in 1 per cent. solutions of methylic alcohol and of glycerol. The author points out that the experimental conditions of growth were widely different from those which obtain when the planets grow naturally, by assimilation of the inorganic salts of the soil; experiments were, therefore, made with pure cultures of the aquatic plant *Lemna minor*, which normally assimilates organic material from aqueous solution. The culture media were solutions of dextrose and of cane-sugar, containing a nitrogenous substance; asparagine, carbamide, glycocine, leucine, alanine, potassium and sodium nitrates, and the chloride and sulphate of ammonium were employed. The cultures were kept in darkness three or four days before use, and thus rendered free from starch; the temperature throughout the experiments being 20°. It was found that when no light was admitted, the plant converted sugar into starch, and absorbed asparagine; hence, when the absorption of the sugar and asparagine occurred simultaneously, and no starch, or traces only, were found in the plant, the author concluded that the sugar had been transformed into albumin. In the presence of asparagine, starch was formed from cane-sugar, whilst none was obtained from dextrose; thus, whilst the plant fails to elaborate albumin from cane-sugar, it is successful in doing so from dextrose. This explains the fact that, in young potato-shoots, asparagine and cane-sugar exist together. Albumin was formed from both cane-sugar and dextrose in the presence of carbamide; from cane-sugar only, when glycocine was employed; and from neither dextrose nor cane-sugar when leucine, creatine, alanine, or the nitrates were present. The ammonium salts gave the same results as asparagine. When albumin is formed from asparagine alone, the presence of potassium or sodium chloride greatly influences the result, and it is probable that the presence of these chlorides is an important factor in plant-growth. W. A. D.

Decomposition Products of the Proteids of Conifer Seeds. By Ernst Schulze (*Zeit. physiol. Chem.*, 1897, **24**, 276—284. Compare Abstr., 1897, ii, 156).—The proteid materials were extracted from *Picea excelsa* by Ritthausen's method, and heated with hydrochloric acid and stannous chloride. Arginine was separated out from the filtrate in large quantities, 100 parts of proteid yielding as much as 10 parts of arginine. In Hedin's researches, the quantity of arginine he obtained from various proteids amounted to 0·25—2·75 per cent. Of the precipitate produced by phosphotungstic acid, two-thirds consisted of arginine, whilst leucine and tyrosine were found in the filtrate. Similar results were obtained with the proteid matter from *Abies pectinata*.

Kossel considers that, on the hydrolysis of protamine, 3 molecules of arginine, 1 of histidine, and 1 of lysine are obtained. The large yield of arginine in the present research suggests that it originates from a protamine nucleus. W. D. H.

Source of Allylthiocarbimide in the Root of Cochlearia Armoracia. By JOHANNES GADAMER (*Arch. Pharm.*, 1897, **235**, 577—581. Compare Abstr., 1897, i, 360).—Alcohol extracts a considerable amount of cane-sugar from the dried and pulverised roots of *Cochlearia Armoracia* (horse-radish); the aqueous extract is bitter, but from it no glucoside could be directly isolated, although its presence is proved by the following experiments.

The united extracts are evaporated, treated with silver nitrate, and the resulting precipitate treated with ammonia, when a silver ammonium compound is produced, identical with the substance obtained in a similar manner from sinigrin, so that, in all probability, the glucoside contains myronic acid (as the potassium salt).

Apparently, in all plants which give allylthiocarbimide on hydrolysis, myronic acid, that is, sinigrin, must be looked on as the source of the thiocarbimide; this point is being further investigated.

A. W. C.

Some Comparatively Rare Constituents of the Carbonised Vinasse of a Beet-Sugar Factory. By EDMUND O. VON LIPPMANN (*Ber.*, 1897, **30**, 3037—3039).—In the course of attempts to refine the carbonised vinasse from a factory in which the recovery of sugar from beetroot molasses is carried out, the author obtained certain muddy residues; these were found to contain 0·03 per cent. of lithium, 0·12 per cent. of titanium, and 0·243 per cent. of manganese, calculated on the dry substance.

Beets that had been manured with chalk mud containing strontium contained 0·21 part per thousand of strontia; the amount of lime commonly present is 0·4—0·5 part. Hay from some red clover which had grown on a heap of strontium residues contained 13·2 parts of strontia per thousand; the usual amount of lime is 20—24 parts. Employment in the sheds where the strontium salts are manipulated has been found to bring on temporary eczema in workmen predisposed to that disease. C. F. B.

Composition of the Ash of Canary Seed. By T. S. HOFMAN (*Landbouwkund. Tijdschr.*, 1897, **5**, 172—173).—The air-dried seed of *Phalaris canariensis*, grown at Wageningen, contained 3·26 per cent. of pure ash (free from sand and carbon) of the following percentage composition.

K_2O.	Na_2O.	CaO.	MgO.	Fe_2O_3.	P_2O_5.	SO_3.	SiO_2.	Cl.
5·3	0·3	1·6	3·9	1·8	22·8	12·9	51·7	1·9

N. H. J. M.

Ash of Gidgea Acacia (Stinking Wattle). By FREDERICK B. GUTHRIE (*Agric. Gaz. New South Wales*, 1897, 8, 868—869).—The pure ash (excluding sand, carbon, and carbonic anhydride) of *Gidgea Acacia* was found to have the following percentage composition.

K_2O.	Na_2O.	CaO.	MgO.	Fe_2O_3. Al_2O_3. SiO_2.	P_2O_5.	SO_3.	Cl.
0·60	0·72	90·71	2·74	1·17	1·47	1·72	0·04

The wood of *Gidgea*, both green and dry, burns completely when once alight, leaving a white ash, which is used for polishing, &c. The wood is excessively hard and very durable. The dry substance of the leaves contains 26·92 per cent. of proteids. N. H. J. M.

Amount and Composition of the Herbage of Meadows at different Periods. By F. VILLARD and F. BŒUF (*Ann. Agron.*, 1897, 23, 497—527).—The experiments were made (1) on a natural meadow, (2) with lucerne, growing on a poor soil, with 30 per cent. of other herbage, mostly coarse grass, and (3) with a mixture of sainfoin (70 per cent.), lucerne (21 per cent.) and miscellaneous herbage. Samples were taken at intervals of a week, commencing May 8 or 14, and the dry matter and the different constituents determined. From the fourth week, the amounts of total produce were also determined. The condition of the crops at the various dates were as follows (the numbers refer to the three experiments):—May 29 (1 and 3), first flowers; June 4, (1) *Leguminosæ* in flower, (2) first flowers; June 11, (1) grasses in flower, (3) in flower; June 18, (1) *Leguminosæ* forming fruit, (3) end of flowering; June 25, (1 and 3) all fruit formed, (2) end of

	Fresh produce.	Dry produce.	Proteid.	Ether extract.	N-free extract.	Cellulose.	Ash.	P_2O_5.	Nutritive ratio.
				Natural Meadow.					
29 May ...	30460	6870	1150	158	3557	1334	673	46	3·22
4 June ...	32520	8050	1228	217	4076	1805	725	43	3·49
11 ,, ...	28160	7180	1045	194	3646	1666	629	39	3·67
18 ,, ...	34210	10110	1370	334	5215	2374	817	47	4·04
25 ,, ...	24760	9032	1061	271	4465	2439	796	55	4·46
				Lucerne.					
4 June ...	26540	6370	903	153	2966	1697	661	25	3·44
11 ,, ...	24370	6180	981	105	2858	1706	529	21	3·02
18 ,, ...	22050	5515	900	121	2515	1561	418	18	2·93
25 ,, ...	19870	5345	802	139	2242	1769	393	19	2·97
2 July ...	21590	7100	936	206	2898	2499	561	24	3·31
				Sainfoin and Lucerne.					
29 May ...	25590	4856	822	126	2532	977	398	24	3·23
4 June ...	25730	5403	928	135	2508	1463	368	26	2·84
11 ,, ...	24920	5906	999	166	2729	1677	359	30	2·87
18 ,, ...	24770	6242	1069	131	2497	1991	554	22	2·45
25 ,, ...	17390	5095	799	143	2168	1667	319	22	2·89]

flowering; July 2, (2) fruit. The summary on p. 181 shows the amounts of fresh and dry produce, and constituents in kilograms per hectare.

The percentage results are also given in tables, and the amounts per hectare are shown in curves in the original.

It is concluded that in deciding as to the best time for cutting, two things must be considered, the amounts of nutritive constitutents in the crop, and the determination of the plants as the season advances. In the case of the mixed herbage of meadows, (1) and the mixture of sainfoin and lucerne, (2) the most favourable time was shown to be the period of full flower. As regards lucerne (2) which begins to deteriorate earlier, the best time was before the flowering period had commenced.

N. H. J. M.

Composition of Buckwheat. By BALLAND (*Compt. rend.*, 1897, **125**, 797—799).—The mean yield of buckwheat in the north-west of France is 17 hectolitres per hectare, the mean weight of a hectolitre being 63·09 kilos. Its composition is as follows. Water, 13·00 to 15·20; nitrogenous matter, 9·44 to 11·48; fats, 1·98 to 2·82; sugars and starches, 58·90 to 63·35; cellulose, 8·60 to 10·56; ash, 1·50 to 2·46 per cent.; acidity, 0·044 to 0·096. The mean weight of 1000 grains varies between 17·80 and 21·50 grams. The grains decorticated by hand contain from 19 to 21 per cent. of envelope, and 79 to 81 per cent. of kernel. The composition of this envelope, which is hard and almost unassimilable, is water, 8·50 to 13·30; nitrogenous matter, 3·18 to 3·68; fats, 0·60 to 0·80; extractive matter, 37·05 to 45·22; cellulose, 40·80 to 44·30; ash, 1·40 to 1·80 per cent. The kernel is white, contains very little cellulose, and is readily assimilable; it contains the same nutritive constituents as wheat, and is useful as human food, as well as for cattle.

C. H. B.

Retrograde Phosphoric Acid. By JULIUS STOKLASA (*Ann. Agron.*, 1897, **23**, 588—594).—The soluble phosphoric acid of superphosphates can never be present in the form of acid ferrous phosphate, as this decomposes as soon as it is formed, yielding ditriferric phosphates of varying composition, insoluble in water. Ferrous salts, in presence of phosphoric acid soluble in water, always give rise to the production of ditriferric phosphates, unless there is an excess of free phosphoric acid. Acid ferric phosphate can only be present if there is at least 30 per cent. of soluble phosphoric acid in the free state. With less than that amount, acid ferric phosphate may be converted into monoditriferric phosphate.

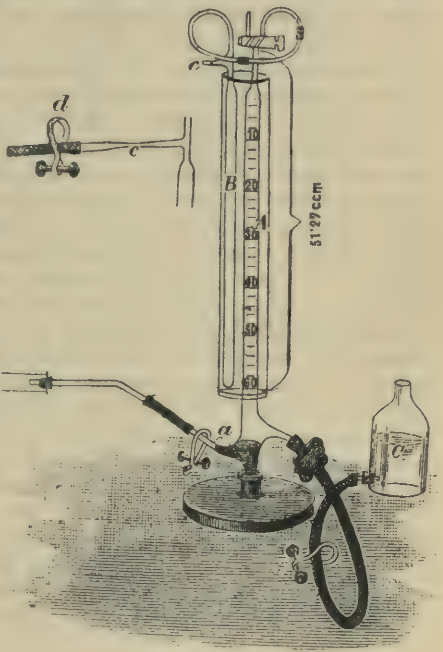
With soluble phosphoric acid, aluminium salts do not form a compound analogous to those produced by ferrous and ferric salts, but behave like the salts of calcium and magnesium.

A number of pot experiments were made in which barley was grown in (1) a fertile soil containing calcium carbonate (0·63 per cent.) and humus (2 per cent.), and in (2) a soil containing 0·31 and 20·2 per cent. of chalk and humus respectively. Each pot received 0·5 gram of phosphoric acid in the form of a particular salt; different phosphates of calcium, aluminium, and iron were employed.

In soil (1), the acid phosphates of lime, iron, and aluminium give the greatest and similar yields of grain. The trimetallic phosphates had little effect, whilst retrograde phosphoric acid (as normal monometallic phosphate) showed a value equal to half that of the trimetallic phosphate. In soil containing over 5 per cent. of chalk, the results would be different, as the acid phosphates would be transformed into trimetallic phosphates. In presence of much humus (soil 2), retrograde phosphoric acid had a value almost equal to phosphoric acid soluble in water. N. H. J. M.

Analytical Chemistry.

Gasometric Apparatus. VII. A New Method for the Absolute Measurement of Gases. (Measurement of the Reduced Gas Volume). By OTTO BLEIER (*Ber.*, 1897, **30**, 3123—3131. Compare this vol., ii, 136).—Two forms of gas measuring apparatus are described, which are provided with compensating tubes, by means of which the volume of the gas at 18° and 760 mm. can be directly read off. The first apparatus is specially intended for the estimation of nitrogen, and resembles in general form the usual azotometer, the compensator (B) being connected with the measuring tube (A) at its upper end by a capillary tube, which contains an index of mercury, by means of which it is possible to adjust the gas in the compensating tube to a fixed volume. The measuring tube is graduated so as to give a direct reading in milligrams of nitrogen. The compensator contains a drop of aqueous potash of the strength used in the estimation of nitrogen, and is adjusted in the first instance by enclosing some definite volume of air in the measuring tube, raising or lowering the reservoir *C* until this occupies the volume which it would have when dry at 18° and 760 mm., and then by means of a side tube *c* making the pressure in the compensator exactly equal to that in the measuring tube. As soon as this is the case, the side tube is sealed and the apparatus is ready for use. The exact position of the mercury index should be determined by actually enclosing various volumes of air in A, reducing them to the volume which they would occupy dry at 18° and 760 mm. and observing the average position of the index. The second form of apparatus is intended for use in the same way as Lunge's gas volumeter and can also be employed for general gas analysis. It consists of the two-limbed measuring vessel previously described, combined with a compensator similar in principle to that referred to above. A. H.



Extraction of Liquids. By AUGUSTIN WRÓBLEWSKI (*Zeit. anal. Chem.*, 1897, **36**, 671—674).—Two forms of apparatus are described and figured, by means of which a substance can be transferred from an aqueous solution to a lighter, immiscible solvent, such as ether or light petroleum. The first resembles a Soxhlet's fat extractor, with the addition of a thistle-headed funnel through which the ether flowing from the condenser is conveyed to the bottom of the aqueous layer, and with the syphon tube inserted half-way up the large cylinder, so as to syphon off the ethereal layer only. The second is on a similar principle, but the ether vapour from the distillation flask bubbles up through the aqueous layer also, and the syphon tube is replaced by a simple overflow tube, inserted at a considerable distance above the surface of the aqueous layer. M. J. S.

Employment of Metallic Sodium, Magnesium, and Aluminium in Qualitative Analysis. By WALTHER HEMPEL (*Zeit. anorg. Chem.*, 1898, **16**, 22—25).—Metallic sodium is conveniently employed in blowpipe-analysis for the reduction of tin oxide to metallic tin, barium sulphate to barium sulphide, and similar operations. A small piece of freshly-cut sodium is pressed out into a thin sheet on a piece of filter paper, and the substance to be analysed is rolled up in this so that two layers of filter paper are on the outside. The small cylinder is then wound round with thin iron wire and heated in a reducing bunsen-burner flame; the action is complete in a few minutes, and the spiral of wire is then pushed into the tube of the burner and allowed to cool in the gas. The cold product is separated from the iron wire and ground in an agate mortar with water, when the reduced metal is easily separated and identified by the usual methods. When the samples for analysis contain silicic or boric acid, the product of the action contains silicon or boron; in this case, it is treated with hydrochloric acid, when the sulphides, if they are present, are detected by lead paper, and the insoluble residue is then washed with water, dried, and heated on a piece of platinum foil, when a mixture of silica and boron trioxide mixed with black silicon or boron is obtained.

When it is necessary to examine the spectrum given by the product of the reaction, metallic magnesium or aluminium should be employed in place of sodium, the sample being mixed with the powdered metal, and rolled in a piece of filter paper and ignited as described above. The product, when dissolved in hydrochloric acid, gives very good flame reactions. E. C. R.

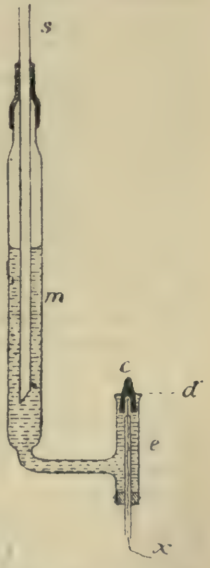
Application of Acid Solutions of Arsenious Acid in Volumetric Analysis. By M. BIALOBRZESKI (*Chem. Centr.*, 1897, **1**, 259—260; from *Pharm. Zeit. Russ.*, **35**, 785—789).—The author has found that the reaction between iodine and arsenious acid takes place quantitatively in the presence of an acetate and free acetic acid at a temperature of about 70°. To estimate the available chlorine in bleaching powder, the prepared solution is mixed with an excess of standard arsenious acid dissolved in ammonium acetate; after acidifying with acetic acid and warming to 60°, the excess of arsenic is titrated with standard iodine. Chlorates may be estimated by first adding excess of the arsenic and then excess of hydrochloric acid; the liquid is afterwards neutralised with ammonia, acidified with acetic acid, and titrated with iodine. Peroxides may be estimated in a similar manner by gently heating them with hydrochloric acid in the presence of an excess of the arsenical solution and titrating the latter as directed. The process may also be applied to chromates and to the indirect estimation of lead. L. DE K.

Employment of Normal Sodium Oxalate in Volumetric Analysis. By S. P. L. Sörensen (*Zeit. anal. Chem.*, 1897, **36**, 639—643).—For the preparation of standard acids with the greatest accuracy, it is an objection to the use of sodium carbonate that it cannot be preserved anhydrous, and that it loses carbonic anhydride on ignition. Sodium oxalate is easily prepared pure; the commercial salt is dissolved in 32 parts of water, the solution made feebly alkaline with soda and allowed to clarify completely; the solution is then evaporated on the water bath to 1/10, the sodium oxalate separating and potassium oxalate remaining in solution. The salt is washed on a suction filter, and recrystallised until the mother liquor is free from chlorides, sulphates, and alkali; the final crystallisation is best performed by running the hot solution into alcohol, as the salt thus obtained does not decrepitate on ignition. Dried at 125—150°, it is anhydrous and not hygroscopic. For use, a weighed quantity is ignited in a platinum crucible, either burning off the separated carbon by fusing the alkaline residue with access of air, or filtering it off after the addition of a very small excess of the acid under examination. Both methods give exactly the same result, no loss of sodium being observable during the fusion.

In six experiments (using three different preparations of oxalate) the greatest deviation from the mean was less than 1/1100 of the total amount.

For standardising permanganate, this salt is to be preferred to either oxalic acid or ammonium oxalate. M. J. S.

Apparatus for the Spark Spectrum of Solutions. By Louis M. Dennis (*Zeit. anorg. Chem.*, 1898, **16**, 19—21).—The advantages of the apparatus are that the splashing on to the slit of the spectroscope is easily obviated, and there is very little waste of the solution which is being examined. The apparatus consists of a short, vertical tube connected with a longer tube bent at right angles, the long arm being about four times the length of the shorter. The shorter arm is open at both ends, and the lower end carries a cork, through which passes a glass tube enclosing a platinum wire which is connected at the top of the arm with a graphite pole arranged at such a height that when the short arm is maintained full of the solution there is a constant supply of the solution to the pole. The longer arm of the apparatus, which acts as a reservoir for the solution, is closed at the top by a piece of rubber tube, through which a glass tube, open at both ends, slides, and can be adjusted so that the height of the bottom of the tube is level with the top of the shorter arm; by this arrangement, as in a Mariotte's bottle, the solution in the shorter arm is kept at a constant level. The slit of the spectroscope is protected from splashes by placing before it a sheet of glass. E. C. R.



Kjeldahl's Process. By JAMES O'SULLIVAN (*J. Soc. Chem. Ind.*, 1897, **16**, 111—112).—Employing an acid consisting of one part of strong sulphuric acid and two parts of Nordhausen acid, adding 0·5 gram of mercuric oxide at the commencement, and completing the oxidation with potassium permanganate, the author has obtained, in the analysis of malt extract and ale, results agreeing accurately with those of the Dumas' nitrogen method. M. J. S.

Volumetric Estimation of the Nitro-group in Organic Compounds. By STEWART W. YOUNG and R. E. SWAIN (*J. Amer. Chem. Soc.*, 1897, **19**, 812—814).—When nitro-derivatives are heated with a hydrochloric acid solution of stannous chloride, the following reaction takes place: $R \cdot NO_2 + 3SnCl_2 + 7HCl = NH_2R,HCl + 3SnCl_4 + 2H_2O$. The authors have so far proved this to be the case with dinitrobenzene. On account of the instability of stannous chloride, the operation is performed in a current of carbonic anhydride, the nitro-compound being first dissolved in alcohol. After two hours' action, the excess of stannous chloride is titrated with standard iodine. (See this vol., ii, 192.) L. DE K.

Gasometric Estimation of Nitrous Acid. By E. RIEGLER (*Zeit. anal. Chem.*, 1897, **36**, 665—668).—The method depends on the oxidation of the nitrous acid to nitric acid by acidified hydrogen peroxide, and the estimation of the excess of the peroxide by treatment with permanganate and measuring the oxygen evolved.

The author employs the Knop-Wagner azotometer. Five c.c. of a 1 per cent. hydrogen peroxide solution, mixed with 30 c.c. of water and 10 c.c. of strong sulphuric acid, is decomposed by about 0·1 gram of potassium permanganate with the usual precautions, and the volume of oxygen read off. Immediately afterwards, the nitrite solution, containing not more than 0·05 gram of N_2O_3 in 30 c.c. of solution, is mixed in the decomposing flask with 5 c.c. of the same hydrogen peroxide and a few drops of sulphuric acid. After shaking and waiting five minutes, 10 c.c. of strong acid is cautiously added, and the decomposition with permanganate carried out as before. The difference between the two volumes of oxygen expressed in cubic centimetres at 0° and 760 mm. is multiplied by 0·0017 to obtain grams of N_2O_3. Instead of permanganate, silver oxide may be used, the hydrogen peroxide being mixed with potassium hydroxide, and silver nitrate being placed in the inner vessel. In this case, twice as much peroxide is employed, and the multiplier is 0·0034.

M. J. S.

Estimation of Phosphorus in Steel. By R. W. MAHON (*J. Amer. Chem. Soc.*, 1897, **19**, 792—795).—The process described is a modification of the method recently introduced, by which the yellow phosphomolybdate precipitate is titrated with standard alkali and acid, using phenolphthalein as indicator. The author has, as yet, only used it for samples low in silicon and carbon, when, under favourable conditions, an assay may be made in eight minutes.

Whilst the drillings are being got ready, 70 c.c. of water and 30 c.c. of nitric acid of sp. gr. = 1·4 is put into an Erlenmeyer flask, the burettes are filled with the respective alkali and acid, and a filter is connected with the filter-pump. Four grams of the drillings is then put into the acid and heated over a gas-burner. When dissolved, 3 c.c. of a standard potassium permanganate is added, and the liquid is boiled until no longer pink; 10 c.c. of hydrochloric acid of sp. gr. = 1·20 is then added, and the boiling continued until the liquid is clear. After cooling for a few seconds, 50 c.c. of molybdate solution and 15 c.c. of ammonia of sp. gr. = 0·90 are added, care being taken not to let them run along the sides of the flask. After shaking for 15 seconds, the precipitate is collected on the filter, washed with cold water, and then placed in a small beaker containing a known volume of the alkali, the excess of which is then titrated with standard acid.

The molybdate solution is made by dissolving 100 grams of molybdic acid in a mixture of 200 c.c. of water and 200 c.c. of ammonia of sp. gr. = 0·90; the solution is then filtered into 1250 c.c. of nitric acid of sp. gr. = 1·20, blowing air through the mixture. L. DE K.

Estimation of Insoluble Phosphorus in Iron Ores. By CHARLES T. MIXER and HOWARD W. DUBOIS (*J. Amer. Chem. Soc.*, 1897, **19**, 614—619).—By insoluble phosphorus is understood that phosphorus which cannot be extracted by boiling hydrochloric acid of sp. gr. = 1·1 from the silicious residue left after the acid treatment of iron ores. The authors, however, find that this modification of phosphorus becomes readily soluble if the residue is ignited.

The details are as follows. 1·5 grams of the ore is dissolved in 25 c.c. of hydrochloric acid, and the excess of acid is removed by evaporating until the mass becomes syrupy. Water is then added, and the insoluble matter collected, washed, and ignited. Five minutes boiling of the ignited residue with dilute hydrochloric acid will now dissolve the remainder of the phosphorus, which is probably present as an aluminium compound. L. DE K.

Qualitative Analysis of Phosphates. By ROBERT M. CAVEN (*J. Soc. Chem. Ind.*, 1897, **16**, 208—209).—When, in the course of a qualitative analysis, the precipitate produced by ammonia contains phosphates, it is redissolved in the least possible quantity of hydrochloric acid, and much ammonium acetate is added with a little acetic acid; any precipitate produced ($FePO_4$,$AlPO_4$,$CrPO_4$) is collected. To the filtrate, ammonium phosphate is added as long as it produces a precipitate, this being collected on the same filter as before; this precipitate is examined for iron, chromium, and aluminium by fusion with pure potassium hydroxide. The filtrate is freed from the excess of phosphate by adding ferric chloride until the precipitate produced remains brown, and then boiling for several minutes; the solution will then be free from iron also, and the alkaline earths, &c., will be detected by the usual methods. Since chromium phosphate is not completely insoluble in acetic acid, a little chromium may be found in the precipitate produced by ferric chloride. M. J. S.

Estimation of Phosphoric Acid by Titration of the Ammonium Phosphomolybdate Precipitate with Standard Alkali. By B. W. KILGORE (*J. Amer. Chem. Soc.*, 1897, **19**, 703—711. Compare Abstr., 1896, 335).—The author having used this process for a considerable time, recommends it as being throughly trustworthy. It must, however, be remembered that the yellow phosphomolybdate precipitate is an acid salt, and not altogether insoluble in water; any attempt, therefore, to absolutely free it from acidity must fail, as this will cause, not only a chemical, but also a mechanical loss. The washing should, therefore, be done with small quantities of water, using altogether 150, or at most not more than 200 c.c.

L. DE K.

Analysis of Silicates. By A. LECLÈRE (*Compt. rend.*, 1897, **125**, 893—894).—Silicates are decomposed when fused with about three times their weight of lead oxide, and when the cooled product is treated with not less than ten times its weight of a mixture of equal volumes of ordinary nitric acid and fuming nitric acid at about 40°, the silica separates completely in a partially hydrated but non-gelatinous form, together with lead nitrate. On diluting with water, the lead nitrate dissolves, and the silica is readily filtered and washed. The filtrate is concentrated and mixed with alcohol and a slight excess of hydrochloric acid, which completely precipitates the lead as chloride. The fusion with lead oxide can be carried out without risk in a platinum crucible, if the latter is heated in a muffle so that reducing gases are excluded, and the oxide is prepared in the following way. An excess of a saturated solution of oxalic acid containing about 3 per cent. of nitric acid is added to a 15 per cent. solution of lead nitrate, and the precipitate of oxalonitrate is dried and heated to dull redness in a porcelain dish; about a quarter of it is then moistened with nitric acid, well mixed with the remainder, and the heating continued.

C. H. B.

Estimation of Carbon in Iron. By E. HARBECK and GEORG LUNGE (*Zeit. anorg. Chem.*, 1898, **16**, 67—75).—The authors review the principal methods for the estimation of carbon in iron, and compare the results they have obtained in this investigation. They conclude that Wöhler's chlorine method and Corleis' method give accurate results, which closely agree with each other; the method described by Lunge and Marchlewski gives results somewhat lower than those obtained by Corleis' method; the results are better in the analysis of steel when copper ammonium chloride is substituted for copper sulphate, although the error is not entirely eliminated. In the case of cast iron, however, the improvement obtained by using copper ammonium chloride is so small as to be valueless. The ordinary copper ammonium chloride method gives results which are no better than those obtained by Lunge and Marchlewski's method, and takes considerably more time. Although Corleis' method is the best when very accurate results are required, for ordinary commercial purposes Lunge and Marchlewski's method is quickest and most convenient, but it must be remembered that there is a constant loss of about 0·03 per cent. of the carbon.

E. C. R.

Flue Gases in Relation to Furnace Efficiency. By P. FRITZSCHE (*Zeit. anal. Chem.*, 1897, **36**, 669—671).—In estimating the efficiency of the fuel burnt in a furnace, it is necessary to know the composition of the fuel as well as that of the flue gases, and in many cases it would be convenient to deduce the former from the latter. Lunge's formula (*Zeit. angw. Chem.*, 1889, 240) for this relates only to fuels containing no hydrogen (coke, anthracite). If, however, the water in the flue gas is estimated, as well as the carbonic anhydride, carbonic oxide, and oxygen, a formula can be developed which applies to all ordinary fuels. This is conveniently done by aspirating 5—10 litres of the flue gas through a weighed calcium chloride tube.

Expressing by n the nitrogen, k the carbonic anhydride, k' the carbonic oxide, and o the free oxygen, all in volumes per cent.; by f the total water, f' the water derived from h the available hydrogen of the fuel, f'' the hygrometric water of the atmospheric air, ϕ the water pre-existing in the fuel, all expressed in grams per cubic metre of dry flue gas :—$f - (f' + f'') = \phi$ and

$$f' = \left[\left\{\frac{n}{3{\cdot}76} - \left(k + \frac{k'}{2} + o\right)\right\} 1{\cdot}429 \times \frac{9}{8}\right] : 100.$$

Also $h = \dfrac{f'}{9}$. The ratio of the carbon to the available hydrogen and the pre-existing water of the fuel must be the same in the fuel as in the flue gases. In the gases, the ratio is $\dfrac{0{\cdot}539\ (k + k')}{100} : h : \phi$. Putting a for the ratio of carbon to hydrogen, and b for that of carbon to water, and denoting by K the carbon in 1 kilogram of fuel free from ash, $K = \dfrac{1}{1 + \dfrac{1}{a} + \dfrac{1}{b}}$. From the value of K thus ascertained, the amount of flue gas derived from 1 kilogram of fuel is calculated in the usual manner. If regard is to be paid to the sulphur in the fuel, the sulphurous anhydride in a cubic metre of flue gas is denoted by s, and putting c for the ratio of carbon to sulphur,

$$f' = \left[\left\{\frac{n}{3{\cdot}76} - \left(k + \frac{k'}{2} + o + s\right)\right\} 1{\cdot}429 \times \frac{9}{8}\right] : 100, \text{ and}$$

$$K = \frac{1}{1 + \dfrac{1}{a} + \dfrac{1}{b} + \dfrac{1}{c}}.$$

M. J. S.

Behaviour of Platinochlorides. By Paul Rohland (*Zeit. anorg. Chem.*, 1897, 15, 412—418).—The estimation of potassium in minerals which, like kainite, contain potassium, sodium, magnesium, calcium, and barium as sulphates and chlorides, is effected by taking advantage of the greater solubility of the chlorides in methylic than in ethylic alcohol. Barium chloride is soluble in 78 parts of methylic alcohol (sp. gr. = 0·790) and in 7000 parts of ethylic alcohol (sp. gr. = 0·8035). The solution of the mineral is treated with a slight excess of barium chloride to precipitate all the sulphuric acid, the clear solution evaporated to a syrup with platinic chloride, and then extracted with methylic alcohol. The sodium, magnesium, and calcium platinochlorides are easily dissolved, and the barium salt is decomposed into platinic chloride and barium chloride, and these salts are also dissolved by the methylic alcohol, leaving a residue of pure potassium platinochloride, which is finally washed with ether. The results of the analysis agree closely with those obtained by reduction of the potassium platinochloride by R. Fresenius' method. E. C. R.

Modified Method of Fine Silver Assay. By AUGUSTUS E. KNORR (*J. Amer. Chem. Soc.*, 1897, **19**, 814—816).—About 1 gram of standard silver is dissolved in a little dilute nitric acid (1 : 2) and heated until all the nitrous acid has been expelled. A standard solution of salt is then added until the bulk of the silver is precipitated, and after thoroughly shaking, the silver chloride is removed by filtration, and the last traces of the silver are then precipitated by means of a standard solution of potassium thiocyanate, using ferric ammonium sulphate as indicator.

The solutions having been thus standardised, are ready for the assay of any given sample of silver. The impurities commonly present in fine silver do not interfere with the process. L. DE K.

Volumetric Estimation of Lime in Sugar Liquors. By N. FRADISS (*Chem. Centr.*, 1897, i, 262—263; from *Bull. Assoc. Chimistes*, **14**, 22).—100 c.c. of the juice, or syrup, is mixed with excess of ammonia and ammonium oxalate, and boiled for 2 hours. The precipitate, after being collected on a filter and well washed, is dissolved in dilute sulphuric acid and titrated, in the usual way with potassium permanganate. L. DE K.

Quantitative Separation of Barium, Strontium, and Calcium. By SIDNEY G. RAWSON (*J. Soc. Chem. Ind.*, 1897, **16**, 113—115).—Calcium nitrate is soluble in concentrated nitric acid, the nitrates of the other two metals being absolutely insoluble. The solution of the mixed nitrates is therefore evaporated to dryness, and the residue digested with nitric acid of 70—80 per cent. The barium and strontium are subsequently separated by the chromate method in acetic acid solution (Abstr., 1893, ii, 436). M. J. S.

Rapid Valuation of Zinc Dust. By ANDRÉ R. WAHL (*J. Soc. Chem. Ind.*, 1897, **16**, 15).—Half a gram of the zinc dust is shaken with 25 c.c. of cold water, and 7 grams of pure neutral ferric sulphate is added. In a quarter of an hour the zinc will have dissolved (with the exception of impurities), with reduction of an equivalent quantity of the ferric salt, and without evolution of hydrogen if acid is absent. The solution is then acidified, and titrated with permanganate. The ferric sulphate is prepared by oxidising a mixture of 5 parts of ferrous sulphate and 1 of sulphuric acid by excess of nitric acid, evaporating to dryness, grinding, and washing with alcohol until no longer acid, and drying thoroughly. A blank assay is desirable.

M. J. S.

Elecrotrolytic Detection of Lead in Urine. By P. WEINHART (*Chem. Centr.*, 1897, i, 129; from *Pharm. Centr. Halle*, **37**, 759—760).—The urine is evaporated on the water bath to half its bulk, mixed with 65 per cent. of nitric acid, and then evaporated to dryness; the residue, taken up with a little nitric acid, is diluted to a litre, heated to 50°, and submitted to electrolysis. The presence of lead is indicated by the deposition of a film of brown lead dioxide on the positive electrode. L. DE K.

Acetylene as a Quantitative Reagent. By HENRIK G. SÖDERBAUM (*Ber.*, 1897, **30**, 3014—3017. Compare Abstr., 1897, ii, 348).—*Separation of Copper from Cadmium.*—The solution, about 150 c.c. in volume, is mixed with 10—15 c.c. of strong aqueous sulphurous acid, and then with 20—25 c.c. of ammonia (sp. gr. = 0·96), warmed on the water bath until it is only faintly blue, and then treated with a current of acetylene gas. The precipitate of copper acetylide is washed 2—3 times by decantation with dilute ammonia saturated with acetylene, and then on the filter with hot water; it is decomposed with nitric acid, and the copper nitrate formed is ignited, and the residue of oxide weighed. The cadmium in the filtrate is determined electrolytically, or by precipitation and weighing as the sulphide.

Separation of Copper from Arsenic.—The solution is treated as in the preceding case, except that enough sodium hydroxide must be added to combine with the arsenious or arsenic acid; when ammonium salts alone are present, traces of arsenic are precipitated along with the copper. The arsenic in the filtrate is determined by oxidising it (if necessary) to arsenic acid, with nitric acid, precipitating it as magnesium ammonium arsenate, and either weighing this, or igniting it and weighing as magnesium pyroarsenate.

The usual error in the determinations quoted was a deficit of about 0·3 per cent. of the total quantity in the case of each metal. An acid solution of mercuric chloride is very efficient in freeing acetylene from hydrogen phosphide (it was recommended for this purpose by Bergé and Reychler), but in the determinations described, there is no actual need to free the acetylene from this impurity. C. F. B.

Modification of the Permanganate Method for the Estimation of Iron. By HAMILTON P. CADY and ALFRED P. RUEDIGER (*J. Amer. Chem. Soc.*, 1897, **19**, 575—581).—The following reagents are required. *A*. A 5 per cent. solution of stannous chloride, which should give no deposit when it is diluted with twenty times its bulk of water and boiled; a little free hydrochloric acid and a few fragments of tin will keep it in good condition. *B*. Hydrochloric acid, made by mixing equal volumes of water and acid of sp. gr. = 1·2. *C*. A solution of mercuric sulphate, made by mixing 200 grams of the salt with 80 c.c. of sulphuric acid, and adding this to 800 c.c. of water; after adding a solution of 100 grams of orthophosphoric acid, the liquid is made up to 1 litre.

1*st Method.*—The iron ore, after being completely decomposed by boiling with 10—15 c.c. of the acid *B*, is diluted to 100 c.c. and reduced by adding to the boiling liquid solution *A* until no thiocyanate reaction is obtained; the slight excess of tin is carefully oxidised by potassium permanganate, and then a few drops only of the tin are added. After cooling, 50 c.c. of dilute sulphuric acid is added, and then, for every 10 c.c. of *B*, 35 c.c. of *C* is added; the whole is made up to 400 c.c., and titrated with permanganate. 2*nd Method.*—To the acid solution, 2 c.c. of *C* is added, the liquid is heated to boiling and *A* is added until a permanent turbidity is produced. The whole is then diluted to 300 c.c., 50 c.c. of dilute sulphuric acid, and 45 c.c. of *C* are added, and the iron is at once titrated with permanganate.

L. DE K.

Electro-analysis of the Metals of the Ammonium Sulphide Group. By M. Engels (*Chem. Centr.*, 1897, i, 258—259; from *Chem. Rundschau.*, 1896, 20—24).—Iron may be separated from manganese by dissolving the mixed sulphates in water contained in a platinum dish which serves as cathode; the anode being a platinum spiral which is immersed in a beaker filled with water, the two vessels communicating by means of an inverted U-tube filled with the liquid. After acidifying with sulphuric acid, the liquid is electrolysed with a current of 0·4—0·8 ampère and 40—60 volts., while hydrogen is passed through the beaker to prevent the formation of permanganic acid; after 12 hours, all the manganese is precipitated, as peroxide, on the anode.

Iron may be separated from aluminium by electrolysing in the presence of an alkaline solution of potassium sodium tartrate, avoiding a large excess of the latter. From nickel, it is best separated in an ammoniacal solution, using a current not exceeding 1 ampère. The nickel is completely precipitated, and is free from iron, if only care has been taken to thoroughly oxidise the latter by means of hydrogen peroxide. In the same manner, nickel may be separated from manganese. The author did not succeed in separating iron from chromium or cobalt.

L. de K.

Iodometric Estimation of Molybdenum. By Hans Euler (*Zeit. anorg. Chem.*, 1897, 15, 454—455).—A reply to the criticisms of F. A. Gooch (this vol., ii, 54).

Titration of Stannous Salts with Iodine. By Stewart W. Young (*J. Amer. Chem. Soc.*, 1897, 19, 809—812).—The author has found that stannous chloride may be accurately titrated in a dilute hydrochloric acid solution by means of standard iodine, using starch as indicator. The potassium iodide, used to dissolve the iodine, should be free from iodate, and the iodine solution should be standardised against a solution of tin of known strength, which has been itself checked by means of a standard solution of potassium dichromate. The tin solution may be kept unaltered for some time by covering it with a layer of paraffin oil.

L. de K.

Qualitative Separation of Arsenic, Antimony, and Tin. By Sidney G. Rawson (*J. Soc. Chem. Ind.*, 1897, 16, 113).—The author advocates Clarke's oxalic acid method, carried out as follows. The washed sulphides are boiled with a small quantity of hydrochloric acid to which a drop of nitric acid is added; this will often suffice to prove the presence of arsenious sulphide, which dissolves with greater difficulty than those of antimony and tin. A strong solution and crystals of oxalic acid are then added, so as to obtain a saturated solution when hot, and hydrogen sulphide is passed through it, when antimony and arsenic are precipitated, whilst the tin remains dissolved. To the filtrate, ammonia is added, and if a precipitate is produced this is redissolved by cautious addition of ammonium sulphide; on adding acetic acid, the tin is precipitated as a mixture of oxide and sulphide. The antimony and arsenic are best distinguished by Hofmann's well known method of passing their hydrides through silver nitrate.

M. J. S.

Separation of Thorium from Cerium. By Ernst Hintz and Hermann Weber (*Zeit. anal. Chem.*, 1897, **36**, 676—685).—Fresh experiments on the separation of thorium from cerium by boiling with sodium thiosulphate (see Abstr., 1896, ii, 677) have shown that with dilute solutions the separation is very nearly perfect, only traces of each metal remaining with the bulk of the other. With strong solutions, the errors are somewhat greater, but still negligible. A re-examination of the ammonium oxalate method (Abstr., 1897, ii, 162) shows that it is far less efficient for separating these metals, and Glaser's modification (Abstr., 1897, ii, 349) is no improvement.

M. J. S.

Value of a Bacteriological Examination of Water from a Sanitary Point of View. By E. K. Dunham (*J. Amer. Chem. Soc.*, 1897, **19**, 591—605).—The paper deals chiefly with the detection of the colon bacilli. As these cannot multiply when putrefying organic matters are absent, a considerable quantity of them may be safely said to indicate an objectionable pollution of the water, although a chemical examination may not point to the presence of excreta.

L. de K.

Quantitative Separation of Ethylene and Benzene Vapour. By E. Harbeck and Georg Lunge (*Zeit. anorg. Chem.*, 1898, **16**, 26—49).—The method is based on the conversion of ethylene into ethane by means of hydrogen in the presence of platinum black. The apparatus employed, which is fully described in the original paper, consists essentially of a capillary tube charged with platinum black so arranged that the sample of gas can be passed through it forwards and backwards two or three times; the platinum black must be saturated with hydrogen at the temperature at which the reaction with ethylene is to take place, the most advantageous temperature being 90—100°. The estimation of the ethylene and benzene in a sample of gas is performed as follows. In a sample of the gas, the ethylene and benzene are estimated together by absorption with fuming sulphuric acid, and the other constituents in the sample are then estimated by the ordinary methods. In a second sample of the gas, the oxygen and acetylene are removed, and the remainder of the sample, which must contain excess of hydrogen, is passed two or three times through the capillary tube charged with platinum black and then treated with fuming sulphuric acid. The quantity absorbed by the sulphuric acid gives the benzene, and the difference between this and that absorbed by direct treatment with sulphuric acid gives the ethylene. Or the ethylene can be estimated in the sample after removal of the oxygen and acetylene by measuring the contraction which takes place on treating the gas with platinum black and hydrogen. This method has, unfortunately, only a very limited application, because the presence of a small quantity of carbonic oxide prevents the reaction between the ethylene and the hydrogen.

The estimation of benzene in coal gas and similar mixtures is effected by passing about 10 litres of the gas through a mixture (110 c.c.) of equal weights of concentrated sulphuric and fuming nitric acids contained in an inclined tube consisting of ten glass bulbs. After the passage of the gas, the acid mixture is poured into water and ice, well cooled with ice, and neutralised with sodium hydroxide. By this means, the dinitrobenzene is obtained as a white, crystalline precipitate which is separated by filtration and washed with water. The filtrate and wash water are made up to a convenient bulk and an aliquot part extracted with ether, the extract separated, evaporated to dryness, and the residue extracted with absolute ether; this ethereal solution, which contains any dinitrobenzene which may have remained in the aqueous filtrate, is evaporated to dryness and the residue weighed. The dinitrobenzene is dried at 70—80° and weighed, the weight being corrected for the quantity extracted from the filtrate by ether. The ethylene present in the gas is also absorbed in the mixed acids, but the products are soluble in water and are not extracted from the aqueous solution by ether.

E. C. R.

Estimation of Glycerol. By BOULEZ (*Zeit. anal. Chem.*, 1897, **36**, 719—720; from *Bull. soc. chim. Nord France*, **4**, 115).—The glycerol is converted into glycerophosphoric acid by trituration with twice its weight of phosphoric anhydride and heating for 7 hours at 130—135°; when cool, the syrupy mixture is dissolved in 20 parts of water and triturated with 10 parts of precipitated calcium carbonate. After 12 hours, with frequent stirring, the calcium glycerophosphate is filtered from the calcium phosphate and excess of carbonate, which are washed with cold water, and the phosphoric acid in the filtrate is estimated by ordinary methods. For impure glycerol, some calcium chloride is added after the calcium carbonate. M. J. S.

Fehling's Solution. By MAX SIEGFRIED (*Ber.*, 1897, **30**, 3133—3134).—The author points out, in reply to Jovitschitsch (this vol., ii, 98) and Gerock (this vol., ii, 147), that the reduction experienced when Fehling's solution, to which some acid has been added, is boiled, is due entirely to the absence of alkali and not to the specific action of the acid or the salt formed by it with the alkali present. A. H.

Detection of Cane-sugar. By GIORGIO PAPASOGLI (*Zeit. anal. Chem.*, 1897, **36**, 715; from *Bull. assoc. chim. sucrerie et distillerie*, **13**, 68).—The aqueous solution is treated with a few drops of a solution of a cobalt salt and a small excess of sodium hydroxide, whereupon an amethyst-violet colour is produced. Grape-sugar yields a blue, passing into dirty green. One part of cane-sugar mixed with 9 parts of grape-sugar can be detected. Coloured liquids must be decolorised, and gum and dextrin, which would obscure the sugar reaction by giving a permanent blue, must be precipitated by ammoniacal lead acetate or baryta. M. J. S.

Estimation of Sugar in Sweet Wines. By J. PINETTE (*Chem. Zeit.*, 1897, **21**, 395).—The sample is treated, as usual, with Fehling's solution, but instead of reducing the cuprous oxide in a current of hydrogen and weighing the metallic copper, the amount of copper is determined by titration.

The filter containing the cuprous oxide is put back into the beaker, opened by means of a rod, moistened with 5 c.c. of strong nitric acid, and 10 c.c. of strong ammonia is added. After the paper has been well broken up, a standardised solution of potassium cyanide is run in until the liquid is colourless. Towards the end, a few drops of potassium ferrocyanide solution (1 : 20) are introduced, and the cyanide solution is added very slowly. The cyanide solution should contain about 60 grams of the salt per litre, and must be standardised by means of metallic copper; this should not vary much in weight from that of the cuprous oxide, and the same quantity of nitric acid and ammonia must be used. L. DE K.

Estimation of Sugar in Chocolate. By XAVIER ROCQUES (*Chem. Centr.*, 1897, i, 268; from *Revue intern. falsific*, 9, 198).—Fifteen grams of the sample is heated with 90 c.c. of water to 40° and well shaken, 15 c.c. of a 10 per cent. solution of lead acetate is added, and the liquid filtered into a graduated measure; 70 c.c. of the filtrate is then mixed with 10 c.c. of acetic acid and 20 c.c. of a 10 per cent. solution of sodium sulphate to remove the excess of lead. The filtrate now contains all the cane-sugar and also any glucose, which can be estimated in the usual way. To invert the cane-sugar, it is sufficient to dilute 50 c.c. of the filtrate with 450 c.c. of water and heat the mixture in the water bath for 3 hours. Dilute acetic acid has no hydrolysing action on dextrin. L. DE K.

Estimation of Starch in Cereals. By JEAN EFFRONT (*Chem. Centr.*, 1897, i, 202—203; from *La Bière*, 4, 145).—Three grams of the finely ground sample is extracted with ether and well rubbed up in a mortar with 20 c.c. of strong hydrochloric acid, which should be gradually added. When the starch is dissolved, water is added to make it up to 100 c.c. After filtering, 75 c.c. of the liquid is exactly neutralised with aqueous soda, avoiding even the faintest alkalinity, then 0·2 c.c. of normal acid is added, the liquid evaporated to one-half on the water bath, and introduced into a 75 c.c. flask. After making up to the mark and filtering a few times through asbestos, the liquid is polarised in a 40 cm. tube, whilst another portion is titrated with Fehling's solution. From the rotation, the amount of dextrin (or starch) may be easily calculated, but allowance must be made for the glucose, which has only 1/3·7 of the rotatory power of dextrin.

L. DE K.

Estimation of Farinaceous Matter in Sausages. By JOSEPH MAYRHOFER (*Chem. Centr.*, 1897, i, 204—205; from *Forsch. Ber. Lebensm.*, &c., 3, 429—430. Compare Abstr., 1897, ii, 525).—From 10 to 20 grams of the sample is heated at 100° with 50 c.c. of an 8 per cent. alcoholic solution of potash until the meat has dissolved; the mixture is then diluted with proof spirit, and the insoluble portion collected on a filter and washed first with hot alcoholic potash and then with alcohol, until the filtrate no longer gives any turbidity on acidifying. The filter with the insoluble matter is now put back into the beaker, and, after being treated for half an hour on the water bath with 60 c.c. of normal potash and allowed to cool, is acidified with acetic acid, and water added to make the whole up to 100 c.c. In an aliquot part of the liquid, the starch is then precipitated by adding an equal volume of strong alcohol; the precipitate is collected, and after being washed first with proof spirit, then with strong alcohol, and finally with ether, is dried and weighed. L. DE K.

Detection of Formalin in Milk. By K. FARNSTEINER (*Chem. Centr.*, 1897, i, 133—134; from *Forsch. Ber. Lebensm.*, &c., 1896, **3**, 363—370).—The author thinks that the various tests for the detection of formaldehyde in milk should be applied, not only to the milk itself, but also to its distillate. The best test is no doubt sulphuric acid containing a *trace* of iron; when applying this to the distillate, some casein should be added (Hehner). L. DE K.

Detection and Estimation of Acetone in Urine. By LOUIS WILLEN (*Chem. Centr.*, 1897, i, 134; from *Schweitz. Woch. Pharm.*, **34**, 433—436).—From 300—500 c.c. of the sample is mixed with 30—50 c.c. of dilute sulphuric acid, and submitted to distillation until 60 c.c. has distilled over; by carefully determining the specific gravity, the quantity of acetone may be calculated from the tables given in the paper. The presence of acetone is then confirmed by the well-known iodoform reaction. L. DE K.

Simplification of Hopkins' Method for Estimating Uric Acid in Urine. By OTTO FOLIN (*Zeit. physiol. Chem.*, 1897, **24**, 224—245).—Ten grams of ammonium sulphate is added to 100 c.c. of urine, and after the mixture has been allowed to remain for 2 hours, the precipitated ammonium urate is washed with a 10 per cent. solution of ammonium sulphate until the washings are free from chlorine. The urate is then dissolved in sulphuric acid and titrated with potassium permanganate in the usual way; an addition of 1 milligram per 100 c.c. of filtrate being made to the end result as a correction for the solubility of the ammonium urate. W. D. H.

Rapid Estimation of Uric Acid in Urine. By E. H. BARTLEY (*J. Amer. Chem. Soc.*, 1897, **19**, 649—656).—The author, after pointing out the defects in the various processes for estimating uric acid in urine, now recommends the following: 100 c.c. of the sample, mixed with 5 c.c. of magnesia mixture and 10 c.c. of ammonia of sp. gr. = 0·960, is heated on the water bath, and N/50 normal silver nitrate is then run in from a burette, a few drops of the liquid being, from time to time, filtered through a miniature cotton filter, and tested for excess of silver by means of a solution of sodium hydrogen sulphide. From the result, 1 c.c. is deducted, that being the amount of silver which will be in excess before any reaction is observed. Each c.c. of silver solution is equivalent to 0·00336 gram of uric acid. L. DE K.

A New Volumetric Method of Estimating Uric Acid in Urine. By FRANCIS WHITTAKER TUNNICLIFFE and OTTO ROSENHEIM (*Brit. Med. J.*, 1898, i, 364).—Uric acid obtained from the urine by Hopkins' method, is suspended in water which is kept boiling, a few drops of alcoholic phenolphthalein are then added, and a N/20 solution of piperidine is run in; the complete saturation of the uric acid present is indicated by the presence of a red coloration, which remains on shaking, and also by the fact that no uric acid remains undissolved.

W. D. H.

Mechanical Arrangement of Fat Extraction Apparatus. By Gustave J. Volckening (*J. Amer. Chem. Soc.*, 1897, **19**, 735—738). This is an ingenious arrangement for using Soxhlet's tubes in which fatty materials are being extracted with ether. The flasks containing the latter are heated on gun-metal steam tables on which small capsules partly filled with water have been placed; or a damp piece of thin felt may be used. The arrangement, which is fully illustrated, will be found very useful to analysts who have to make many fat estimations with but limited space in their laboratories. L. de K.

A Simple Fat Extractor. By Vernon J. Hall (*J. Amer. Chem. Soc.*, 1897, **19**, 586).—The apparatus consists of a small shallow dish made of very light copper and furnished at the bottom with two tightly fitting caps, one of which is shallow whilst the other resembles a Gooch's crucible. When required for use, the shallow cap is fitted on, 5 c.c. of milk is introduced into the previously weighed apparatus, and after drying for half-an-hour on the water bath, the residue will be dry enough for weighing. The shallow cap is now removed and placed inside the dish, the perforated one, packed with asbestos, is substituted and a weighed beaker is placed underneath. Boiling ether or benzene is then poured into the dish, and after 50 c.c. has run through, all the fat will be extracted. L. de K.

Estimation of Fat. By Erwin Voit [and Otto Krummacher] (*Zeit. Biol.*, 1897, **35**, 555—582).—See this vol., ii, 175.

Analysis of Fats. The Gravimetric Bromine Method. By Julius Lewkowitsch (*J. Soc. Chem. Ind.*, 1896, **15**, 859).—In consequence of the statement of Hehner (*Analyst*, 1895, 148) that the action of bromine on unsaturated fatty substances is complete and quantitative, the author has applied the gravimetric bromine method (Hehner, Abstr., 1895, ii, 428) to a variety of oils, and from the bromine values thus found has calculated the corresponding iodine numbers. In the case of olive oil and rape oil, the numbers so obtained agreed closely with those of Hübl's method, but in all the other cases the discrepancy was very wide, and on that account the gravimetric bromine process is regarded as unfit for employment in fat analysis. M. J. S.

Bromine Absorption of Fats and Oils. By Otto Hehner (*J. Soc. Chem. Ind.*, 1897, **16**, 87—89).—This paper is in part a reply to that of Lewkowitsch (preceding abstract). The author reproduces the table originally published in *The Analyst* (Abstr., 1895, ii, 428) by which he showed that the amount of bromine absorbed by certain fats, as ascertained by the increase in weight, is in molecular proportion to the Hübl iodine number. The greatest discrepancy observed by Lewkowitsch was in the case of linseed oil, two specimens of which absorbed 18·68 and 10·4 per cent. of bromine, corresponding with 30·02 and 16·98 per cent. of iodine respectively, whereas the Hübl number for linseed oil ranges from 154 to 190. The author is unable to corroborate these low numbers, and refers to the experience of Williams (Abstr., 1896, ii, 281); the latter, since the date of that publication, has further examined upwards of 200 samples of linseed oil by the gravimetric bromine method, with results ranging from 110 to 120 per cent., but on two occasions has obtained low results (71·5 and 62·2) with specimens of apparent genuineness.

The bromination of a fat is accompanied by a considerable development of heat. If 1 gram of the fat, dissolved in 10 c.c. of chloroform, is treated with 1 c.c. of bromine, the rise of temperature, expressed in Centigrade degrees, gives, when multiplied by 5·5, a very close approximation to the Hübl number. The experiment is best made in a vacuum-jacketed tube. M. J. S.

Hehner's Bromine Tests for Oils. By JOHN H. B. JENKINS (*J. Soc. Chem. Ind.*, 1897, **16**, 193—195).—The author's experience of the gravimetric bromine absorption method and the bromothermal method corroborates that of Hehner, with linseed, as well as other oils. The results agree best, however, when the brominated oils are dried for 5 hours at 97°. At 125°, a continuous, though small, loss of weight occurs. M. J. S.

Detection of Foreign Fats in Lard and Butter. By C. B. COCHRAN (*J. Amer. Chem. Soc.*, 1897, **19**, 796—799).—Two c.c. of the melted lard or butter is introduced into a 25 c.c. graduated cylinder and dissolved by the aid of a gentle heat in 20 or 8 c.c. respectively of amylic alcohol (sp. gr. = 0·8159 ; boiling point, 129°). After cooling to 16—17°, the contents are kept at that temperature for two or three hours, and the deposit, which, if the lard is pure, should not exceed 4 c.c., is transferred to a small filter and the fusel oil drained off. The residue is then transferred to a test-tube and dissolved in ether, the tube plugged with cotton wool, and the ether allowed to slowly evaporate ; the crystals which form are afterwards mounted in cottonseed oil and microscopically examined. If the sample contains 10 per cent. of beef-fat, there will be no difficulty in recognising beef-stearin ; with 20 per cent. of adulteration, lard-stearin will be practically absent. L. DE K.

Estimation of Unsaponifiable Oil in Greases with a Lime Base. By HENRY BAILEY (*Chem. News*, 1897, **76**, 174).—In the usual method, entailing complete saponification and extraction of the dried soap, the operations of drying and extraction are both unsatisfactory ; they are obviated in the following method. Ten grams of the grease is completely decomposed by boiling and stirring with hydrochloric acid, and is then filtered, on a filter previously moistened with water, and washed free from hydrochloric acid with boiling water, any slight iridescence in the filtrate being ignored. The oils are heated and stirred with about 2 grams of strong potash and some alcohol, that is renewed from time to time, but when saponification is complete is nearly all evaporated away. The residue is warmed with about 100 c.c. of water until clear, and when cool is twice extracted with ether or light petroleum, using 30 c.c. the first and 20 c.c. the second time, a few drops of alcohol being added if the separation is not sharp. The combined extracts are evaporated in a tared wide mouthed flask and dried at a little above 100° until constant in weight. D. A. L.

Estimation of Phenylhydrazine. By HENRI E. CAUSSE (*Compt. rend.*, 1897, **125**, 712—714).—When phenylhydrazine is boiled with arsenic acid in presence of acetic acid, it is completely decomposed, with formation of nitrogen, phenol and water, the arsenic acid being reduced. 198 grams of arsenious acid are formed for every 108 grams of phenylhydrazine oxidised.

About 0·2 gram of phenylhydrazine, free or in combination, is mixed with excess of a solution prepared by dissolving 125 grams of arsenic acid in a mixture of 450 grams of water and 150 grams of concentrated hydrochloric acid, filtering after cooling, and then diluting to 1000 c.c. with glacial acetic acid. The mixture is gently heated and finally boiled in a reflux apparatus. After about 40 minutes, the liquid is allowed to cool, made alkaline with sodium hydroxide solution, reacidified with hydrochloric acid, mixed with excess of sodium hydrogen carbonate and titrated with decinormal iodine solution.

The method is applicable to combinations of phenylhydrazine with aldehydes. If the aldehyde belongs to the benzene series, it has no influence on the result, but if it belongs to the acetic series it must first be removed.

Under certain conditions, phenylhydrazine forms a crystallisable compound with salicylic acid. C. H. B.

Testing Quinine. By MELCHIOR KUBLI (*Arch. Pharm.*, 1897, **235**, 619—633. Compare Abstr., 1896, ii, 550, and 1897, ii, 83, 168, 391).—Controversial. A reply to Hesse's remarks concerning the author's methods. A. W. C.

Analysis of Asphalt. By HERMANN ENDEMANN (*J. Soc. Chem. Ind.*, 1896, **15**, 871—876; 1897, **16**, 121—126).—From the researches of Boussingault, asphalt has hitherto been regarded as a mixture of a volatile hydrocarbon, petrolene, with a non-volatile substance, asphaltene, containing about 15 per cent. of oxygen, the asphaltene being the predominant constituent. More recently, the separation of these substances by means of solvents, especially light petroleum, has been employed for the purpose of analysing asphalt. The author shows that the results obtained by these methods may be entirely misleading. That portion of the asphalt which is insoluble in light petroleum, and is regarded as Boussingault's asphaltene, is, nevertheless, easily soluble in a mixture of petrolene with light petroleum, and is partially precipitated when the strong solution is diluted with petroleum, or with the weaker washings. As a consequence of this solubility, the proportion of petrolene in an asphalt is largely overstated when separation by solvents is attempted. On re-examining Boussingault's method of separating petrolene and asphaltene by heat, it was ascertained that the non-volatile portion absorbs a large amount of oxygen when heated in air; so that Boussingault's asphaltene is not really a constituent of natural asphalt, but is an oxidised product. This, and the fact that when this oxidised residue is dissolved in chloroform it is always accompanied by metallic oxides, induce the author to propose for it the name *asphaltic acid*, reserving the name asphaltene for that constituent of asphalt which remains when asphalt is heated at 250° in an atmosphere free from oxygen, and which has the empirical formula $C_{13}H_{18}O$. This asphaltene, which is entirely non-volatile, and is hard and brittle in the cold, fuses at 210°, and, when heated at 250° in air, becomes covered with a wrinkled skin, increases in weight, and ultimately becomes hard and dry like sand, being converted into asphaltic acid. The latter is a black substance, which dissolves in soda, and is reprecipitated by acids. Although itself insoluble in chloroform, its compounds with metallic oxides seem to be soluble in a chloroform solution of asphaltene. It has the formula $C_{26}H_{26}O_4$, containing, therefore, the same percentage of oxygen as Boussingault's asphaltene. Its solution in sodium hydroxide readily absorbs oxygen, and this oxidised solution gives, with hydrochloric acid, a brown precipitate, which is a strongly acid substance of the formula $C_{26}H_{20}O_{12}$, for which the name *asphaltulmic acid* is suggested.

The soft and liquid asphalts known as malthas are hydrocarbons entirely free from oxygen, and containing a much larger proportion of volatile substances than the solid asphalts. A specimen was freed from petrolene by distillation in a vacuum. The residue was repeatedly washed with boiling alcohol, then dissolved in ether, and after removal of the ether was analysed. It is an inodorous, pale-coloured gum, with the formula $C_{26}H_{38}$. When heated in air, it is converted into asphaltic acid ; the name *asphaltogen* is, therefore, adopted. It is solid at ordinary temperatures, but fuses below 100°, and is soluble in ether, whereas asphaltene is insoluble. As a practical application of the above facts, it is proposed that asphalts should be analysed by the following process : 5 grams of the asphalt is treated with chloroform, the insoluble matter is collected and treated in the usual manner, and the filtered chloroform solution is distilled from a weighed flask, the residue being dried for half an hour at 120°. A weighed quantity of this residue (0·2—0·3 gram) is then heated in a porcelain boat at 250° in a current of carbonic anhydride for 12 hours. The loss is reported as petrolene, the residue as asphaltene and ash. The results so obtained differ greatly from those of the treatment with solvents, but are far better adapted for controlling the practical applications of the material.

M. J. S.

Detection of Urobilin. By Georges Denigès (*Chem. Centr.*, 1897, i, 1128 ; from *J. Pharm.*, [vi], 5, 395—397).—To prepare a dark-coloured urine for the spectroscopic detection of urobilin, 10 c.c. is mixed with 5 c.c. of mercuric sulphate solution, prepared from 5 grams of mercuric oxide, 20 c.c. of concentrated sulphuric acid, and 100 c.c. of water. An ammoniacal solution of urobilin gives a reddish colour with mercuric sulphate, and a violet colour with nickel and copper salts.

M. J. S.

Detection of Urobilin in Urine. By G. Leo (*Chem. Centr.*, 1897, i, 440 ; from *Boll. Chim. Farm*, 1897, 36, 69—70).—The urobilin is precipitated with basic lead acetate, the precipitate washed first with water and then with a little absolute alcohol, and treated with alcoholic ammonia (10 c.c. of alcohol to 2 c.c. of aqueous ammonia). This extracts sufficient urobilin from the precipitate to give after concentration the characteristic fluorescence with ammoniacal zinc chloride.

M. J. S.

General and Physical Chemistry.

Relations between Molecular Structure and the Absorption Spectra of Colourless Organic Compounds. By Walthere Spring (*Rec. Trav. Chem.*, 1897, **16**, 1—25).—Organic compounds generally regarded as colourless, have usually a pale blue tint when hydroxyl groups are present, this being the more marked the shorter the carbon chain, but in the absence of hydroxyl groups the colour inclines to yellow. Many of these compounds also give band absorption spectra, and 51 liquids were spectroscopically examined by means of a direct vision spectroscope the compounds including alcohols, acids, ethers, ethereal salts, aldehydes, nitro-compounds and hydrocarbons. The alcohols gave one band the position of which undoubtedly depends on the molecular structure, but the author does not find the simple direct relation to the molecular weight which was found by Russell and Lapraik (Trans., 1881, 168). The acids also gave a spectrum with one band, but in the case of the ethers and ethereal salts, two bands were obtained which correspond closely in position with those of the related alcohols, or alcohol and acid, for example, ethylic acetate gave bands at 632 and 615 (arbitrary scale), whilst the bands of ethylic alcohol and acetic acid are at 633 and 615 respectively. In some cases, however, the juxtaposition of the bands causes coalescence, so that only one band results. The absorption band in benzene is in the same position as one of those present in benzoates, &c., and may be regarded as due to the phenyl group, but in toluene and xylene, &c., this band is displaced and approaches the position of the methyl band. Nitrobenzene and nitrotoluene do not give the multitude of bands characteristic of nitric peroxide, but have two bands only, one of which is peculiar to the phenyl derivatives, the other being probably indicative of the nitro-group.

L. M. J.

Photoelectric Properties of Salts previously Coloured by Heating in the Vapour of Alkali Metals. By Julius Elster and Hans Geitel (*Ann. Phys. Chem.*, 1897, [ii], **62**, 599—602).—It has been shown by Goldstein (Abstr., 1895, ii, 150) that many salts become coloured under the influence of the cathodic discharge, and salts so coloured possess the peculiarity of readily losing negative electrification when subjected to the influence of bright light. A similar coloration of salts has been produced by Giesel (Abstr., 1897, ii, 170) and Kreutz (Abstr., 1897, ii, 210) by subjecting the salts to the action of sodium or potassium vapours, and the authors now show that salts so coloured exhibit the photoelectric peculiarity noticed in the case of those coloured by the cathodic discharge, as do also, but to a less extent, some naturally coloured varieties of rock salt. It hence appears probable that the coloration is due to a dilute solution of the metal in the solid salt, although it is noteworthy that Abegg found no indication of alkalinity in solutions of these coloured salts. The view of

Kreutz that the presence of iron salts is a cause of the coloration does not receive support. L. M. J.

Change of the Zinc Sulphate in the Clark Cell. By WILHELM JAEGER (*Ann. Phys. Chem.*, 1897, [ii], **63**, 354—365).—At 39°, the ordinary crystals of zinc sulphate, $ZnSO_4 + 7H_2O$, change into crystals of the composition $ZnSO_4 + 6H_2O$. There is a break in the solubility curve at this point, the solubility of the new salt being greater than that of the original compound. In keeping with this, the E. M. F. of the Clark cell shows a change at 39° on heating, and it is possible to cool the cell down again in such a way as to prevent a return of the zinc sulphate to the ordinary condition, abnormal values for the E. M. F. being thus obtained at ordinary temperatures. Two curves are thus obtained for the E. M. F. of the Clark cell. For the normal cell containing $ZnSO_4 + 7H_2O$

$$E_t = 1{\cdot}400_5 - 0{\cdot}00152\ (t - 39) - 0{\cdot}000007\ (t - 39)^2.$$

For the abnormal cell containing $ZnSO_4 + 6H_2O$

$$E_t = 1{\cdot}400_5 - 0{\cdot}00102\ (t - 39) - 0{\cdot}000004\ (t - 39)^2.$$

In using the Clark cell, care should therefore be taken not to raise the temperature above 40°, and to make certain that the zinc sulphate is present in its normal state. H. C.

Theory of Galvanic Polarisation. By ANTON OBERBECK (*Ann. Phys. Chem.*, 1897, [ii], **63**, 29—35).—The determination of galvanic polarisation in a closed circuit is regarded by Streintz as impossible (Abstr., 1896, ii, 460), but the author would except from this generalisation polarisation due to very weak or to very strong currents. A mathematical treatment of the question is given. H. C.

Electrosynthesis. By WILLIAM G. MIXTER (*Amer. J. Sci.*, 1897, [iv], **4**, 51—62).—Mixtures which readily explode when subjected to an ordinary electric spark may not do so under the influence of the electric glow in an ozonising tube. Thus, oxygen and hydrogen in the ratio 1 : 2 at 235 mm. pressure did not explode, but combined slowly. Various explosive mixtures were therefore subjected to the glow discharge in eudiometer tubes and the rates of combination determined, but as no determinations of the current strength were taken, the relation between the rate of combination and the quantity of electricity discharged was not obtained. Hydrogen and oxygen were found to slowly combine, carbonic oxide and oxygen combined more rapidly, and even when perfectly dry combined slowly. Methane and oxygen combine in a manner consistent with complete combustion, but in the case of mixtures of acetylene with oxygen, ethylene with oxygen, and ethane with oxygen the quantity of the latter gas used is less than that required for complete combustion, whilst small quantities of the hydrocarbons were decomposed with the formation of acetylene. Very little ozone is formed during the discharge, and the oxidation cannot be due to its formation. The author does not consider the combination to be due to the union of ions, but to the interaction of the molecules themselves, which are made active by the glow discharge. L. M. J.

Electrochemical Notes. By HANS JAHN (*Ann. Phys. Chem.* 1897, [ii], **63**, 44—55).—Arrhenius (Abstr., 1893, ii, 441) has shown that when an alkali salt is electrolysed with a mercury cathode, a considerable time elapses from the beginning of the electrolysis before hydrogen makes its appearance. The explanation offered, that hydrogen is not a primary product of the electrolysis, but results from the action of the water of the solution on the alkali-metal amalgam primarily formed, has been called in question by Le Blanc (Abstr., 1894, ii, 225). As no direct proof of the formation of an alkali-metal amalgam in the process has been given, the author here shows by direct calorimetric measurements that such an amalgam must be formed during electrolysis with a mercury cathode.

A modification of the De la Rue cell is described in which the double salt, $ZnCl_2,2KCl$, is used in place of zinc chloride alone. The formation of an insoluble basic salt is thus avoided. The E. M. F. of the cell in volts at the temperature t is given by the formula $E = 1{\cdot}0136 - 0{\cdot}000194t$. H. C.

Electrolysis of Platinic Chloride. By FRIEDRICH KOHLRAUSCH (*Ann. Phys. Chem.*, 1897, [ii], **63**, 423—430).—In the electrolysis of hydrogen platinochloride, H_2PtCl_6, chlorine appears at the anode and platinum and hydrogen both appear at the cathode. It is, however, doubtful whether the platinum is a primary product of the electrolysis. The ordinary crystallised platinic chloride, $PtCl_4 + 5H_2O$, when dissolved in water and electrolysed, gave, with weak currents, hydrogen alone at the cathode, no platinum separating, and at the anode oxygen was obtained. With stronger currents, a deposit of platinum appears on the cathode and oxygen at the anode. The author regards the deposition of platinum in the last case as due to secondary action, and suggests that platinic chloride exists in solution as H_2PtCl_4O, with the ions H_2 and $PtCl_4O$. The secondary deposition of platinum may be due to the reaction $2H_2 + 3H_2PtCl_4O = Pt + 2H_2PtCl_6 + 3H_2O$ as the solution gradually changes to one of hydrogen platinochloride. The platinum cathode becomes bent during the passage of the current, perhaps owing to occlusion of the hydrogen taking place with contraction in volume. H. C.

Electrolysis and Electrolytic Conductivity of certain substances dissolved in Liquid Ammonia. By HAMILTON P. CADY (*J. Physical Chem.*, 1897, **1**, 707—713).—The dissociative power of liquid ammonia on dissolved substances has been tested by determining the electrolytic conductivity of the solutions. Ordinary commercial liquid ammonia was used, its determined conductivity being 71×10^{-7}. The presence of a small amount of water does not seem to have a measurable effect on either the conductivity of ammonia alone, or of solutions of substances dissolved therein. When a small quantity of a soluble salt is added to the ammonia, the solution becomes an excellent conductor. In the case of sodium or potassium salts, the solution turns blue during electrolysis, but becomes colourless again when the current is shut off. When a current is passed through a solution of an ammonium salt in ammonia, there is a violent evolution of gas but no signs of a blue coloration. In neither of these experiments could any evidence be detected of a blue coloration that might be ascribed to the presence of free ammonium. When a current is passed through solutions of salts of silver, copper, or barium, the metals are deposited on the cathode, but there is no sign of a blue colour. A solution of sodium in ammonia is of a bright blue colour, and is an excellent conductor. There is no deposit on the electrodes, no gas is evolved, and the blue colour is not altered by the passage of an enormous quantity of electricity. If only a little sodium is present, the colour becomes more intense round the cathode. There is no polarisation current.

Whilst regarding his results as preliminary, the author concludes that ammonia seems to possess the power of dissociation of dissolved substances to as great an extent as water, and in most cases the ions seem to travel even faster in it than in water. The work is to be continued. H. C.

Conductivity of Solutions of some Salts in Pyridine. By St. von Laszczynski and Stanislaus von Gorski (*Zeit. Elektrochem.*, 1897, 4, 290—293).—The electrolytic conductivities at 18° of solutions of potassium, sodium, and ammonium iodides and thiocyanates and of lithium chloride in pyridine were investigated. The conductivity of the pyridine itself was inappreciable. The molecular conductivity increases more rapidly with increasing dilution than is the case with aqueous solutions, the rate of increase passing through a maximum value. A similar peculiarity has been observed in the case of other organic solvents, in isolated instances also with water. In accordance with Carrara's view, the authors consider the maximum to indicate a maximum dissociating power of the solvent. Lithium chloride solutions in pyridine have a remarkably low conductivity; this may be due to the formation of the salt $LiCl_2,2C_5H_5N$ which has been isolated in the crystalline condition.

Metallic sodium has little or no action on pyridine, but attempts to prepare alkali metals by electrolysis of solutions of their salts in pyridine were not encouraging. A blackish crust containing metallic lithium was obtained from a solution of the chloride, and a yellowish grey crust, containing a little potassium, from a solution of potassium thiocyanate, but the metal acts on the dissolved salt, forming sulphide. An attempt to prepare ammonium amalgam by electrolysis of a pyridine solution of ammonium thiocyanate gave no definite result, whilst solutions of magnesium, cerium, and cobalt chlorides and of silver iodide were found to be non-conductors. T. E.

Ionic Reactions and their Significance in Electrochemistry. By Friedrich W. Küster (*Zeit. Elektrochem.*, 1897, 4, 105—113).—A lecture, dealing more especially with the bearing of the ionic hypothesis on analytical chemistry, in which the following lecture experiments are described.

In order to show the electrical exchange represented by the equation $Cu^{++} + Fe = Cu + Fe^{++}$, pieces of iron and copper are immersed in a solution of sodium sulphate, the former near the top, the latter near the bottom of the vessel; a few crystals of copper sulphate being brought into the liquid near the copper, a current at once flows from the copper to the iron through the external circuit. The change, $2Fe^{+++} + Fe = 3Fe^{++}$, is similarly illustrated by using two iron plates in a solution of common salt and placing some ferric chloride near the lower one.

The electrical exchanges connected with the reversible reaction, $Fe^{++} + I = Fe^{+++} + I^-$, are shown by means of two platinum electrodes standing in small crystallising dishes which are placed in a larger dish; the latter is filled with a solution of potassium chloride and, under it, some iodine is placed in the one small dish and a strong solution of ferrous chloride in the other; the current then flows (in the external circuit) from the iodine to the ferrous solution, but by increasing the concentration of the iodine ions or of the ferric ions the reaction, and with it the direction of the current, is reversed. The change, $I^- + Br = Br + I$, is demonstrated in a similar manner. If electrodes of iron and platinum respectively are immersed in a solution of potassium chloride, and a little iodine added in the vicinity of the platinum, a current is developed owing to the reaction $Fe + 2I = Fe^{++} + 2I^-$.

A saturated solution of hydrogen chloride in toluene does not conduct electricity, even under a pressure of 72 volts; nor does it act on calcium carbonate, but the addition of a little water enables it to do both the one and the other. A saturated (about 0·1 normal) solution of carbonic acid colours methyl-orange less intensely red than a 0·01 normal solution of acetic acid owing to the difference in their dissociation. The diminution of dissociation produced by increasing the concentration of one ion is shown by adding a trace of sodium hydrogen carbonate to the carbonic acid, whereon the red colour disappears, or of sodium acetate to the acetic acid solution. No change of colour is produced by adding sodium chloride to a weak solution of hydrochloric acid coloured by methyl-orange. Another phenomenon of a similar kind is the precipitation of lead chloride from its saturated solution by the addition of a solution of common salt.

The presence of copper in the form of a cathion in a solution of copper sulphate, and in the form of a complex anion in Fehling's solution, is proved by passing a current through two U-tubes, one of which contains a solution of cupric sulphate on the surface of which a solution of sodium sulphate floats whilst the other is similarly filled with Fehling's solution and an alkaline solution of Rochelle salt. The blue zone in the one tube moves in the same direction as, in the other tube in the opposite direction to, the current. The absence of cupric ions from Fehling's solution is further shown by means of a galvanic cell containing lead and copper immersed respectively in solutions of lead acetate and copper sulphate; in this combination, lead dissolves and copper is precipitated, but both the reaction and the direction of the current are reversed when an alkaline solution of Rochelle salt is added to the cupric sulphate solution.

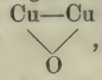
T. E.

Determination of the Expansion of Water between 0° and 40°. By Pierre Chappuis (*Ann. Phys. Chem.*, 1897, [ii], **63**, 202—208).—The expansion of water between 0° and 40° was measured, a platinoiridium dilatometer being used. A table is given of the densities, referred to the maximum density as unity, these numbers varying only slightly in the sixth decimal place from those given by Thiesen, Scheel, and Diesselhorst (Abstr., 1897, ii, 307). H. C.

New Form of Constant Volume Air Thermometer. By J. R. Erskine Murray (*J. Physical Chem.*, 1897, 1, 714—717).—A constant volume air thermometer is described in which the total pressure of the enclosed air, and hence its temperature, is measured directly by the height of one column of mercury. The external atmospheric pressure is eliminated by the adjustment of an auxiliary reservoir of mercury. H. C.

Experimental Determination of the Hydrothermal Value of a Bomb Calorimeter. By Harvey W. Wiley and W. D. Bigelow (*J. Amer. Chem. Soc.*, 1897, **19**, 439—451).—The authors describe the direct experimental determinations of the water equivalent of a bomb calorimeter by the addition of warm water to the calorimeter immersed in cold water. The temperature of the warmer water was only about 10 degrees above that of the cold water, but temperatures were read to 0·001° by means of Beckmann thermometers. The various necessary precautions are noted, and the values obtained directly were 406·6, 407·4, 398·1, and 410·3, the value calculated from the weights and specific heats of the various parts being 410·6. The Regnault-Pfaundler correction for the cooling effect of the surrounding atmosphere is, in the authors' opinion, practically unnecessary. L. M. J.

Heat of Neutralisation of Glycerophosphoric Acid. By H. Imbert and G. Belugou (*Compt. rend.*, 1897, **125**, 1040—1042).—The neutralisation of glycerophosphoric acid by sodium hydroxide develops +14·95 Cal. for the first equivalent, 13·75 Cal. for the second equivalent, and +0·1 Cal. for the third equivalent. With potassium hydroxide, the values are +15·9, +13·9, and +0·4 Cal. respectively. The values for the first and second equivalents are practically identical with those obtained with phosphoric acid. The fact that there is practically no thermal disturbance on adding a third equivalent of alkali shows that the group, $CH_2\cdot CH(OH)\cdot CH_2\cdot OH$, has displaced the hydroxyl group with the alcoholic function. C. H. B.

Heat of Dissociation of Molecules of Elements. By Wilhelm Vaubel (*J. pr. Chem.*, 1897, [ii], **55**, 542—547).—The difference between the heats of formation of $2Cu_2O$ and $2CuO$ is 72 Cal., and on the assumption that the actual heat evolved by the union with the same quantity of oxygen is the same for cuprous and cupric salts, this value, 72 Cal., is the heat required to effect the separation of the copper atoms. The value similarly obtained for mercury is 228 Cal., and these two values are in the same ratio as the atomic weights of the two elements. Since, however, the separation is only for  $\underset{O}{\overset{Cu-Cu}{\diagdown\diagup}}$, and not for $Cu{=}Cu$, the actual values for the dissociation heat are double the above values, that is, 144 and 456 Cal., in which case the proportionality to the atomic weight extends also to iodine, the heat of dissociation of which was found by Boltzmann to be 285 Cal. The heat of dissociation of nitric peroxide is hence calculated as 104·9 Cal., whilst the value deduced by Berthelot and Ogier was 106 Cal.; that of hydrogen must hence be very small, and this result is in accord with Jahn's observations (Abstr., 1896, ii, 230). Similar calculations deduced from the thermal relations of the chlorides do not lead to concordant results, but in this case the fundamental assumption probably does not hold. L. M. J.

Some Boiling Point Determinations. By H. J. STEUBER (*J. Physical Chem.*, 1897, 1, 643—646).—A determination of the boiling points of solutions containing alcohol, salt, and water shows that the presence of alcohol increases the apparent reacting weight of the salt. A similar increase is observed if sugar is substituted for salt.

H. C.

Solubility and Boiling Point. By OLIVER W. BROWN (*J. Physical Chem.*, 1897, 1, 784—786).—Steuber (preceding abstract) has shown that when salt or sugar is added to aqueous alcohol the boiling point does not rise as much as when pure water is taken. A natural conclusion is that the disturbing influence of the alcohol would be less if the substance added were soluble both in alcohol and water. Experiments with carbamide confirm this view. H. C.

Vapour Pressure of Dilute Aqueous Solutions at 0°. By KONRAD DIETERICI (*Ann. Phys. Chem.*, 1897, [ii], 62, 616—643).—Since the freezing point of a solution is not accurately a linear function of the osmotic pressure (Abstr., 1894, ii, 343), the author has determined directly the vapour pressure of a number of dilute solutions. The apparatus employed has been previously described (*Ann. Phys. Chem.*, [ii], 50, 47), and depends essentially on the motion of a membrane subjected, on one side, to the vapour pressure of the solution, and, on the other, to that of pure water; the motion of the membrane is communicated to a mirror and hence to a scale, the scale readings being calibrated by the use of a solution of known vapour pressure. Dilute solutions of phosphoric acid, sulphuric acid, sodium chloride, calcium chloride, cane-sugar, dextrose, and carbamide were examined at various dilutions, and the molecular lowering calculated at each dilution. In the case of sulphuric acid solutions, the molecular reduction of the vapour pressure *decreases* with increasing dilution, and appears to reach a minimum for a N/10 solution, a result in accord with the observations of Ponsot (Abstr., 1896, ii, 412) and of Loomis (Abstr., 1896, ii, 352). Similar results were obtained with phosphoric acid and calcium chloride solutions, but for sodium chloride the molecular reduction remains constant between the dilutions N/1 and N/10. For all the electrolytes, therefore, the effect of dilution is the reverse of that predicted by the dissociation theory. The experiments with solutions of cane-sugar, dextrose, and carbamide lead to analogous results, the author's determinations agreeing with those of Loomis in so far that very dilute solutions gave a value lower than the normal value, whilst the results further indicate that the molecular reduction of the vapour pressure is dependent on the nature of the dissolved substance. L. M. J.

Vapour Pressure of Reciprocally Soluble Liquids. By WILHELM OSTWALD (*Ann. Phys. Chem.*, 1897, [ii], **63**, 336—341).—The question whether two liquids are completely or only partially miscible with one another is generally one of temperature. As all vapours are completely miscible down to the critical temperature, liquids must be completely miscible at this temperature; but below this temperature a separation may take place. The existence of a "critical solution temperature" at which this first occurs has been indicated by Masson (Abstr., 1891, 791). At the critical solution temperature, the two saturated solutions which the liquids form have the same composition, the same vapour pressure, and therefore also vapours of identical composition. The composition of the liquid therefore, at this point, must be the same as that of the vapour which it emits on boiling. The author shows that below this point the composition of the distillate obtained from a mixture of two partially miscible liquids, may be also considered as that of a liquid mixture which, if homogeneous, would have the same composition as its vapour. H. C.

Vapour Tensions, Freezing and Boiling Points of Ternary Mixtures. By W. LASH MILLER (*J. Physical Chem.*, 1897, **1**, 633—642).—A theoretical paper dealing with one of the functions introduced by Gibbs in his "Equilibrium in Heterogeneous Systems." H. C.

Vapour Pressures of Hydrated Salts which remain transparent on Efflorescence. By GUSTAV TAMMANN (*Ann. Phys. Chem.*, 1897, [ii], **63**, 16—22).—If a crystal loses water without losing its transparency, it may be regarded as forming a system composed of a solid and a gaseous phase which is not in complete equilibrium, the number of phases being only equal to the number of substances present, and the vapour pressure will therefore depend on the amount of water which has been removed from the solid phase. Measurements are given of the water lost by the minerals heulandite, chabazite, and desmine (stilbite) when exposed over sulphuric acid solutions of varying concentrations, and it is shown that the vapour pressure varies with the amount of water lost. H. C.

Vapour Pressure Method of determining Molecular Weights. By WILLIAM R. ORNDORFF and H. G. CARELL (*J. Physical Chem.*, 1897, **1**, 753—759).—The authors employ a method similar to that used by Will and Bredig (Abstr., 1889, 820) for the determination of the molecular weights of a number of compounds in alcoholic solution. The rate at which the air passes through the apparatus is found to influence the results. Phenol gave numbers rather lower than the theoretical, but in the other cases examined a fair agreement was obtained. H. C.

Cryoscopic Experiments with the Acetyl Derivatives of the Ethereal Tartrates. By EMANUELE PATERNÒ and C. MANUELLI (*Real. Accad. Linc.*, 1897, [v], **6**, i, 401—405).—The authors have made determinations of the molecular depression of the freezing point of diethylic diacetyldextrotartrate by toluene, paraxylene, naphthalene, nitrobenzene, ethylic oxalate, and diethylic monoacetylmalate; the mean molecular depression thus obtained is 133·2. The racemic isomeride gives about one-half the normal depression, using the dextrotartrate as solvent; if the racemate is dissociated in the solution, the molecular depression is due to the molecules of the lævotartrate only. The racemate is dissociated in freezing benzene. W. J. P.

Use of Methylic Oxalate in Cryoscopy. By G. AMPOLA and C. RIMATORI (*Real. Accad. Linc.*, 1896, [v], 5, ii, 404—407).—Determinations of the molecular depression of the freezing point of methylic oxalate by toluene, ethylic oxalate, bromoform, paraxylene, nitrobenzene, veratrole, phenol, thymol, trimethylcarbinol, caprylic alcohol, isobutyric acid, valeric acid, and the diethylic ether of glycerol show that, as a solvent in cryoscopic work, methylic oxalate behaves somewhat differently from veratrole; in methylic oxalate, the alcohols and acids give abnormally low molecular depressions, which decrease as the concentration increases. The mean molecular depression of the freezing point of methylic oxalate is 52·87. W. J. P.

Relations between the Molecular Weights and Densities of Liquids and Solids. By UGO ALVISI (*Real. Accad. Linc.*, 1897, [v], 6, i, 77—85. Compare Abstr., 1895, ii, 307).—From the consideration of a large number of tabulated data, the author concludes that the molecular volumes of the oxides of the composition R_2O is twice that of those of the oxides RO of the same metal; R may be either Pb, Hg, or Cu. Relations may also be formulated between the molecular volumes V of the oxides of metals in adjoining vertical columns of Mendeléeff's periodic classification; these are of similar form to V of CaO/V of $SrO = V$ of K_2O/V of Rb_2O. Many relations of this type are quoted, and the principle is enunciated that equal volumes contain equal numbers of equivalent weights of matter; this is well illustrated by a table showing the molecular and equivalent volumes of the organo-metallic derivatives. There is, in many cases, considerable deviation from the law, owing to the conditions not being comparable. Tables are given showing the volume constants of the oxides and sulphates, and of salts of the composition MRO_3, M_2RO_3, and M_3RO_3. W. J. P.

Relation of the Taste of Acids to their Degree of Dissociation. By THEODORE W. RICHARDS (*Amer. Chem. J.*, 1898, 20, 121—126).—The sour taste of acids is attributed to the hydrogen ions liberated in their aqueous solutions. This view is supported by the fact that a solution of hydrochloric acid, of distinctly sour taste, becomes tasteless when neutralised with potash. From this, the author also concludes that potassium and chlorine ions possess much weaker taste than hydrogen ions. Dilute solutions of less ionised acids, for example, acetic and tartaric acids, are not so sour to the taste as corresponding solutions of the mineral acids. The addition of small quantities of sodium acetate to dilute solutions of hydrochloric and acetic acid diminishes their taste to a marked extent. This is in accordance with the view that the almost wholly dissociated sodium acetate is capable of destroying the freedom of the hydrogen ions.

The author finds that the end-point of a reaction between decinormal solutions of acid and alkali can be detected by the sense of taste to within 0·5 per cent. W. A. D.

Direct Measurement of Osmotic Pressure. By Andrea Naccari (*Real. Accad. Linc.*, 1897, [v], 6, i, 32—37).—The author has examined the osmotic pressure law, using for the osmometer a porous pot washed with potash, water, hydrochloric acid, and lastly water; the membrane is formed by placing the pot in 3 per cent. copper sulphate solution and after removing the solution and superficially washing, introducing a 3 per cent. potassium ferrocyanide solution into the pot.

Using such a vessel with solutions of glucose, mannitol, salicin, and antipyrine, a fairly good correspondence was obtained between the observed and calculated values of the osmotic pressures. Glycerol solutions set up a low osmotic pressure, owing apparently to the permeability of the membrane to glycerol; unsatisfactory results were also obtained with phenol. W. J. P.

Osmotic Pressure and Electrolytic Dissociation. By Isidor Traube (*Ber.*, 1898, **31**, 154—159. Compare Abstr., 1895, ii, 308). —The author has previously arrived at the conclusion that the contraction which occurs when a substance is dissolved in water is proportional to the concentration of the solution and is almost independent of the nature of the dissolved substance. The contraction is about 13·5 c.c. for every dissolved gram-molecule of a non-electrolyte or for every dissolved gram ion of an electrolyte. It is thought that the contraction in aqueous solutions is due to the strong attraction between the solvent and the dissolved substance, and this leads to the hypothesis of union (changing union) between the water and the dissolved substance. The number of water particles (a) with which a given molecule of a substance in dilute solution combines, is equal for all non-electrolytes, and for dissolved electrolytes increases proportionally to the number of ions. From this, Van't Hoff's conclusion, that the osmotic pressure of a solution is equal to the pressure which the dissolved substance in the form of a gas would exert at that temperature, may be deduced.

In this deduction, use is made of the hypothesis that a molecule of any non-electrolyte in any dilute solution at any given moment is in union with only one particle of the solvent. The author proceeds to show that his views and those of Poynting are more in accord with observed facts than are the usual views of osmotic pressure. Explanations are given for the following facts: (1) Molecular weights as determined in different solvents vary, (2) colloidal substances have an osmotic pressure = 0 or nearly 0, (3) the course of any given reaction depends largely on the nature of the solvent employed (Menschutkin), (4) inversion of sugar and similar processes.

The hypothesis of electrolytic dissociation, according to Arrhenius, is considered quite superfluous. The author's view is that in dilute solutions of, say, sodium chloride, one molecule of sodium chloride is united to two of water, in concentrated solutions to one of water. J. J. S.

[Osmotic Pressure and Electrolytic Dissociation.] By ISIDOR TRAUBE (*Ber.*, 1898, **31**, 160—162).—A reply to Jahn's criticisms (this vol., ii, 153).

Absorption of Gases in Liquids at Various Temperatures. By CHRISTIAN BOHR (*Ann. Phys. Chem.*, 1897, [ii], **62**, 644—651).—The relation between the absorption coefficient and temperature is given by the equation $a(T-n)=k$, where a is the absorption coefficient, T the absolute temperature, and n and k constants for each gas,* and this form of expression is found to give good agreement with the observed values in the cases of hydrogen, oxygen, nitrogen, carbonic oxide, carbonic anhydride, nitric oxide, and ethylene, in water, and of carbonic anhydride, nitric oxide, nitrous oxide, methane, and ethylene, in alcohol. The expression is tested to 45° in the case of the first four gases; for the rest, it is tested only to 26°, and above these temperatures graphical construction shows that aT is no longer a linear function of a, that is, the expression is no longer valid. For the aqueous solutions, the value of n appears to be a function of the molecular weight of the dissolved gas, being given by the equation $\sqrt{M}=0{\cdot}04968\,n-6{\cdot}286$. L. M. J.

Influence of the Solvent on Ionic Velocities. By CARLO CATTANEO (*Real. Accad. Linc.*, 1896, [v], **5**, ii, 207—214).—The author has determined the ionic velocities of chlorine in sodium and ammonium chlorides in aqueous and glycerol solutions at 20—25°. For sodium chloride, the mean ionic velocities of the chlorine in water and glycerol are 0·658 and 0·645 respectively, the corresponding values for ammonium chloride being 0·510 and 0·568; the values for sodium chloride are less in mixtures of water and glycerol than in either of these solvents separately, λ being the molecular conductivity, $10^8\lambda$ were found to be 1020 and 4·03 for sodium chloride in water and glycerol respectively, whilst for ammonium chloride the values 1200 and 5·20 were respectively obtained. W. J. P.

Ionic Velocity of Chlorine in Hydrogen Chloride Dissolved in Various Solvents. By CARLO CATTANEO (*Real. Accad. Linc.*, 1897, [v], **6**, i, 279—286).—The author has determined the ionic velocity of chlorine in hydrogen chloride dissolved in water, ethylic alcohol, methylic alcohol, amylic alcohol, glycerol, ether, and chloroform, and gives the numerical results in tabular form; the velocity constant has practically the same value, namely, 0·21 in water, ethylic alcohol, ether, and solutions of hydrogen chloride in chloroform, whilst a slightly higher value, namely, 0·24, is obtained in methylic and amylic alcohols and glycerol. W. J. P.

Formation and Transformation of Hylotropic-isomeric Forms of Compounds. By KARL SCHAUM (*Ber.*, 1898, **31**, 126—129).—The author applies the term hylotropic-isomeric to such forms of compounds as can change directly into other forms, examples being cyanic and cyanuric acids, rhombic and monosymmetric sulphur, &c. The physical, as distinguished from the chemical, isomerism of crystallised substances is characterised by the power to change directly into a different form in the absence of any solvent; when no such change can be effected, the case is to be considered one of tautomerism, even in the absence of direct chemical evidence. Thus the two forms of metanitracetotoluidide described by Gattermann yield solutions which are identical in properties, but cannot be made to pass directly from one form to the other, and hence must be considered as tautomeric.

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* It may be noticed that the expression given simplifies to $a_t=a_0/(1+kt)$.

The author's experiments with benzophenone, which will be subsequently described, lead him to suppose, in opposition to Ostwald's view (Abstr., 1897, ii, 308), that some substances in the "metastabile" state can be converted into a more stable form in the absence of crystals of the substance, by means the exact nature of which has not yet been ascertained. A. H.

Accidental Causes of Non-reversibility in Chemical Changes. By Albert Colson (*Compt. rend.*, 1897, **125**, 945—947).—When phosphoric acid is displaced from normal sodium phosphate by dry hydrogen chloride, considerably more than half the phosphoric acid is converted into pyrophosphoric acid. One of the factors in the inverse change is thereby destroyed, and the reaction becomes non-reversible. In the action of hydrogen sulphide on silver sulphate, the liberated sulphuric acid interacts with the remaining hydrogen sulphide, water and sulphurous anhydride being formed, and consequently this reaction also is non-reversible, even when the temperature has not exceeded 10°.

C. H. B.

Explosion Figures. By Johannes Pinnow (*J. pr. Chem.*, 1897, [ii], **56**, 520—521).—When a mixture of hydrogen and oxygen gases is exploded in tubes which have been dusted with lycopodium powder and then allowed to remain for several days, the water is deposited in rings; on warming the tube, the rings disappear, but are re-formed in part as the tube cools, and precisely at the original places. Their position can be fixed by passing in silicon fluoride, and the deposits so obtained can be photographed. The distance between the rings varied from 2·8 to 4·2 mm. as the diameter of the tube varied from 1·4 to 2·0 cm., being greater as the diameter is greater; the length of the tubes varied from 12·6 to 19 cm. C. F. B.

Two Liquid Phases. By Wilder D. Bancroft (*J. Physical Chem.*, 1897, 1, 647—668).—In continuing a discussion of the cases dealt with in a former paper (this vol., ii, 65), the author gives a graphical representation of the equilibria in three-component systems when one pair, two pairs, and three pairs of the components can form two liquid phases. H. C.

Ternary Mixtures. By Wilder D. Bancroft (*J. Physical Chem.*, 1897, 1, 760—765).—With two partially miscible liquids and a third consolute with the other two, it is always possible to prepare a series of solutions any one of which will cloud on addition of a drop of either of the two partially miscible liquids. On the triangular diagram (this vol., ii, 65) is given the general form of the isotherm for a system composed of two partially miscible liquids, and a third miscible in all proportions with the other two, and it is shown how phenomena such as the above can then be deduced. H. C.

Precipitation of Salts. By A. Ernest Taylor (*J. Physical Chem.*, 1897, 1, 718—733).—In continuing the work of Bathrick (Abstr., 1897, ii, 135) on the precipitation of salts from aqueous solutions by alcohol and acetone, further confirmation of the previous results was obtained. To ternary mixtures of this type, equations of the general form $(x+A)y^n=C$ and $(x+A)(y+B)^n=C$ apply. The constant n is independent of the temperature, but varies with the precipitating agent. A and B vary with the temperature, and are each characteristic of one of the non-miscible substances, A being a function of y and B of x. H. C.

Fourth Annual Report of the Committee on Atomic Weights. By Frank W. Clarke (*J. Amer. Chem. Soc.*, 1897, 19, 359—369).—A review of the work done on atomic weight determinations during 1896, including a table of values representing the results obtained by combining all the best data. A. W. C.

Molecular Weights of some Carbon Compounds in Solution. By Clarence L. Speyers (*J. Physical Chem.*, 1897, 1, 766—783).—The molecular weights of a number of carbon compounds were determined by the boiling point method, a modified form of the apparatus devised by Orndorff and Cameron (Abstr., 1895, ii, 480) being used. The solvents employed were water, methylic, ethylic, and propylic alcohols, chloroform, and toluene. The results are given in tabular form. H. C.

Molecular Weights of Solid Substances. By Isidor Traube (*Ber.*, 1898, 31, 130—137. Compare Abstr., 1897, ii, 478).—By a comparison of the specific gravities of a number of solid organic substances (as determined by Schröder), the author is able to show that the volume of the group CH_2 is practically the same in solid as in liquid compounds; the extreme variations being, however, $+20$ and -14 per cent. of the mean value. Assuming that this also holds good for the atomic volumes of the elements, it is possible to calculate the co-volumes for a number of solid substances, the result being that the co-volume for the solid state appears to have about half the value which it possesses for liquids. Since a diminution of the co-volume on solidification can only be due to the association of molecules, the author assumes that the co-volume for the solid state is in reality equal to that for the liquid state, and that Avogadro's law holds for the solid state. Hence he is able to calculate the association factor for the compounds in question, and finds that it is roughly equal to 2, all these compounds being therefore bimolecular in the solid form. This conclusion is confirmed by a comparison of a number of inactive racemic compounds, which are undoubtedly bimolecular, with the corresponding active components, the latter are found to have the same co-volumes, and therefore must also be bimolecular. An application of the same method to inorganic salts shows that those which yield two ions are bimolecular, whereas those which yield three ions are monomolecular.

The author adduces Küster's experiment on naphthol and naphthalene in favour of his views, as well as the fact that a large number of solid compounds have vapour densities at low temperatures which correspond with a molecular weight double that which they possess at high temperatures. A. H.

Constitution of Inorganic Compounds. VII. The Molecular Weights of Inorganic Salts. By ALFRED WERNER (and in part P. FERCHLAND, A. MAIBORN, W. SCHMUJLOW, and M. STEPHANI) (*Zeit. anorg. Chem.*, 1897, 15, 1—41).—The molecular weights of a number of inorganic salts were determined by the rise of the boiling point of an organic solvent in which little or no dissociation would be expected to occur. It was found that many nitrogen and sulphur compounds are very suitable solvents, and piperidine, pyridine, benzonitrile, methylic sulphide, and ethylic sulphide were so employed, the inorganic salts examined being chiefly the halogen salts of silver, cadmium, tin, copper, mercury, lead, iron, zinc, cobalt, nickel, and aluminium. Many of the salts were found to form additive compounds with piperidine, and similar combinations occur in a few other cases such as lead nitrate with pyridine, cuprous chloride or cadmium iodide with methylic sulphide, and mercuric iodide with ethylic sulphide. The molecular constant for each solvent was obtained by means of solutions of anthracene and diphenylamine with the following results: methylic sulphide, 18·5; ethylic sulphide, 32·3; pyridine, 30·07; piperidine, 28·4; benzonitrile, 36·55. Most of the salts examined gave results corresponding with a simple normal molecular weight. Aluminium chloride gave elevations corresponding with $AlCl_3$, analogous results obtaining for ferric chloride. Cobaltous chloride and bromide, stannous chloride and bromide, and lead nitrate are all monomolecular, that is, contain bivalent metallic atoms. Remarkable results were, however, found in the case of the cuprous salts, as cuprous bromide gave, in ethylic sulphide, the elevation corresponding with the molecular weight 226, but in methylic sulphide and pyridine that corresponding with the value 140 ($CuBr = 143$), whilst cuprous chloride gave the molecular weight 120 in all solvents, and cuprous cyanide gave the value corresponding with $Cu_2(CN)_2$. It hence appears that the normal molecules of the cuprous salts are represented by the simple formulæ CuCl, &c., with partial association to Cu_2Cl_2, but as the result may be also explained by dissociation of the more complex molecules, conductivity determinations were also made, and these indicated the absence of metallic ions ($\mu = 0·05$). A similar tendency to polymerise was observed in the case of the silver haloids, which gave elevations corresponding with double and treble molecules, a result which the author considers is a further confirmation of his views regarding the constitution of the cuprous salts. L. M. J.

Inorganic Chemistry.

Effect of Light on the Combination of Hydrogen and Bromine. By J. H. KASTLE and W. A. BEATTY (*Amer. Chem. J.*, 1898, 20, 159—163).—When glass bulbs, filled with a mixture of hydrogen and bromine, and heated to 196° in the vapour of boiling orthotoluidine, are exposed to direct sunlight, a rapid combination of the elements takes place, the amount of change being proportional to the time of exposure to light. When the bulbs are heated to the same temperature in the dark, little or no action occurs. The hydrogen used in all the authors' experiments, although in several cases carefully purified, was not freed at all from moisture. W. A. D.

Dissociation and Polymerisation of Gases and Vapours; Dissociation of Chlorine at High Temperatures. By ANATOLE LEDUC (*Compt. rend.*, 1897, **125**, 937—939).—The author compares the densities of chlorine between 0° and 1400° as calculated by his method (this vol., ii, 108) with the observations of Friedel and Crafts, Jahn, Crafts, and V. Meyer. The numbers show that there is no appreciable dissociation up to 440°, and Meyer's numbers, which are not very concordant, indicate that there is no dissociation at 900° and 1200°. The only evidence of dissociation is the number 2·02 (Calc. 2·4483) observed by Crafts at 1400°, and this is an isolated observation. C. H. B.

Electrolysis of Hydrochloric Acid. By FRITZ HABER and S. GRINBERG (*Zeit. anorg. Chem.*, 1898, **16**, 198—228).—The original paper contains a full discussion of the theoretical bearing of the results obtained by the authors. In concentrated hydrochloric acid, chlorine is formed at the anode in theoretical quantity, the amount decreasing as the acid is diluted, until only a small percentage is produced. Traces of hypochlorous acid are found at the anode in the electrolysis of dilute acid. Chloric acid amounting to one-third of the quantity which can be theoretically produced by the current employed is found in solutions varying from normal to N/30, small quantities of hydrogen peroxide accompanying the chloric acid. Perchloric acid is formed in dilute acid to an amount corresponding with one-fourth of that theoretically possible from the current employed. Oxygen is evolved at the anode; in dilute acids, the oxygen evolved constitutes 50 per cent. of the gas from the anode. E. C. R.

Oxygen at Low Pressures. By RICHARD THRELFALL and FLORENCE MARTIN (*Chem. News*, 1897, **76**, 283—284).—Oxygen under a pressure of 0·25 mm. of mercury was caused to bubble through a solution of starch and potassium iodide in glycerol at the rate of 20 bubbles a minute, and altogether for 17½ hours, but no visible effect was produced, although when electrically ozonised 20 bubbles of the same oxygen produced a faint yellow colour. Hence the peculiar behaviour of oxygen at low pressures does not seem to be due to the formation of ozone. D. A. L.

Combustion in Rarefied Air. By A. BENEDICENTI (*Real. Accad. Linc.*, 1896, [v], **5**, i, 404—410).—With the object of elucidating the question of combustion at high altitudes, the author has made experiments on the burning of a lamp fed with olive oil under various atmospheric pressures. He finds that combustion is just as complete under 360 mm. pressure, corresponding to an altitude of 6000 metres, as at ordinary pressures, the only difference being that the speed of combustion is less at the lower pressure; no appreciable increase occurs in the quantity of carbonic oxide produced as the pressure diminishes. W. J. P.

Behaviour of Sodium Thiosulphate Solutions with Acids. By GEORG AARLAND (*Chem. Centr.*, 1897, i, 677; from *Phot. Arch.*, **38**, 17—20).—The author finds that when a solution of sulphurous acid is added to a solution of sodium thiosulphate, no decomposition takes place, although the mixture is strongly acid, and with zinc evolves hydrogen. Moreover, such a mixture may be boiled with dilute sulphuric acid without causing any precipitation of sulphur.

E. W. W.

Nitrohydroxylamic Acid. By ANGELO ANGELI (*Gazzetta*, 1897, **27**, ii, 357—367).—The author gives an improved method for preparing nitrohydroxylamine (Abstr., 1897, ii, 24); since this substance behaves as a dibasic acid, it is now called nitrohydroxylamic acid. The sodium or potassium salt is prepared by dissolving caustic alkali in absolute ethylic, or, better, methylic, alcohol, decanting from the aqueous layer, and adding the calculated quantity of hydroxylamine hydrochloride dissolved in alcohol; after filtering and cooling, the requisite amount of ethylic nitrate is added, when the alkali salt soon begins to separate. The *potassium* salt resembles the sodium salt, but is more hygroscopic.

From a discussion of the properties of the new acid, and allied facts, the author assigns to it the constitution $NO\cdot N(OH)_2$. It is noteworthy that, on adding nitrobenzene to a sodium ethoxide solution of hydroxylamine hydrochloride, after separating the precipitated sodium chloride, a crystalline deposit slowly separates, which, when dissolved in water and acidified with sulphuric acid, yields the nitrosophenylhydroxylamine, $NO\cdot NPh\cdot OH$, obtained by Bamberger by the action of nitrous acid on phenylhydroxylamine; the author regards it as the oxime of nitrobenzene. W. J. P.

Phosphorus Oxide. By J. ADOLPHE BESSON (*Compt. rend.*, 1897, **125**, 1032—1033).—When a concentrated solution of phosphorous acid is treated in a reflux apparatus with excess of phosphorus trichloride at about 100°, the liquid gradually becomes thick, and eventually a mixture of phosphoric anhydride and phosphorus oxide in equal molecular proportions is obtained. On adding the crude product gradually to water, washing the undissolved portion with cold water, and drying in a dry vacuum, pure phosphorus oxide, P_2O, is obtained as a reddish solid. It can also be prepared by the action of dry air in the dark on a solution of phosphorus in carbon tetrachloride. It is best to have an excess of phosphorus present, and to conduct the operation at a temperature a little above its melting point. C. H. B.

Salts of Phosphorous Acid. By BRUNO GRÜTZNER (*Arch. Pharm.*, 1897, **235**, 693—699).—When a solution of pure phosphorous acid is added to antimony oxide, a *salt* of the composition $SbO\cdot H_2PO_3$ is obtained, crystallising in microscopic needles. No salt could be prepared from the oxide and acid potassium phosphite.

Bismuth oxide gives rise to the salt $Bi_2(HPO_3)_3 + 3H_2O$; whilst with aluminium oxide the neutral phosphite is not obtained, but a basic salt, of the probable composition $Al_2(HPO_3)_3,Al_2(OH)_6$; ferric hydroxide behaves in a similar manner.

The hydroxides of chromium, cobalt, and nickel dissolve readily in phosphorous acid to form very concentrated solutions, but under no conditions could precipitates be obtained. A. W. C.

Amount of Carbonic Anhydride in the Atmosphere. By Arvid G. Högbom (*Chem. Centr.*, 1897, i, 452; from *Svensk. kemisk. Tids.*, 6, 169).—The amount of carbonic anhydride contained in the sedimentary carbonates may be reckoned, according to the author, as equal to about 25,000 times that contained in the air. As only a very small proportion of this quantity can have existed in the atmosphere since there was life on the earth, before this time there must have been a continual supply of this gas from volcanic exhalations. This cannot, however, have been a very constant source, as periods of extreme volcanic activity seem to have been followed by periods of comparative quiescence. Hence, according to the author, the amount of carbonic anhydride in the atmosphere probably varied with the geological periods. E. W. W.

Reduction of Carbonic Anhydride at Ordinary Temperatures. II. The Behaviour of Magnesium. By Adolf Lieben (*Monatsh.*, 1897, 18, 582—588).—This is a continuation of the author's work on the reduction of carbonic anhydride in aqueous solution. (Compare Abstr., 1895, ii, 348.) By the action of platinised magnesium on aqueous solutions of carbonic anhydride, either in the presence of disodium phosphate and ammonium carbonate, or better, of potassium sulphate, to which baryta-water is slowly added, traces only of formic acid are obtained. Under the same conditions, which are those most favourable for the reduction (*loc. cit.*), by using sodium amalgam or aluminium amalgam in place of magnesium, large quantities of formic acid are produced. The author considers that these differences are to be explained by the difference in the thermal energy accompanying the liberation of the hydrogen by sodium amalgam or aluminium amalgam, as compared with that in its liberation by platinised magnesium. W. A. D.

Potassium and Rubidium Fluorosulphates and Fluorophosphates. By Rudolph F. Weinland and J. Alfa (*Ber.*, 1898, 31, 123—126. Compare Abstr., 1897, ii, 312).—*Tripotassiumdifluorodisulphate*, $K_3HF_2S_2O_7 + H_2O$, is formed when a solution of potassium sulphate in 40 per cent. hydrofluoric acid is concentrated at a moderate temperature. The salt crystallises in long, colourless prisms with oblique ends, and can be recrystallised from hydrofluoric acid, but not from water; it does not lose weight in a desiccator, but gives off the greater part of its water at 105°, the remainder at 190°. It slowly decomposes in moist air, forming hydrofluoric acid and potassium sulphate, and when heated melts, and then loses water and hydrogen fluoride. A corresponding *rubidium* salt exists, which closely resembles the foregoing in all its properties, but no other analogous compound has been obtained.

Potassium monofluorophosphate, $KHFPO_3 + H_2O$, is formed when the residue obtained by evaporating a mixture of tripotassium phosphate with potassium hydroxide in molecular proportion, is dissolved in hydrofluoric acid and the solution concentrated. It crystallises in colourless, lustrous, quadratic tablets, and decomposes in moist air in a similar manner to the fluorosulphate. It cannot be recrystallised either from water or hydrofluoric acid, and loses hydrogen fluoride when heated. As in the case of the sulphate, the only analogous salt is that of *rubidium*. The authors ascribe the following constitutional formulæ to these salts, $SOF(OK)_2{\cdot}O{\cdot}SOF(OK){\cdot}OH{\cdot}OH{\cdot}POF{\cdot}OK$.

A. H.

Sodium Carbide. By CAMILLE MATIGNON (*Compt. rend.*, 1897, **125**, 1033—1035).—Sodium carbide (compare Abstr., 1897, i, 390) is a white solid of sp. gr. = 1·575 at 15°, insoluble in all solvents. Although an endothermic compound, it is not sensitive to either shock or friction. It is not affected by dry air or oxygen at the ordinary temperature, but when gently heated it becomes incandescent, and is converted into sodium carbonate. When thrown into chlorine, it becomes incandescent, with liberation of carbon ; bromine attacks it explosively, with formation of carbon bromides ; iodine converts it into the carbide, C_2I_4, melting at 185°. Hydrogen has no action on the carbide ; phosphorus combines violently with it at a temperature above 50°, and yields sodium phosphide. When thrown on water, the carbide decomposes violently, with liberation of carbon ; but when acted on more gradually it is completely converted into acetylene sodium hydroxide. When placed in hydrogen chloride, the carbide burns, with production of sodium chloride and liberation of hydrogen and carbon, but if suspended in ether, hydrogen chloride converts it completely into acetylene and sodium chloride. In carbonic anhydride or sulphurous anhydride, the carbide becomes incandescent, either at the ordinary temperature or on gently heating, with liberation of carbon. Carbonic oxide has no action on the carbide below 250° ; hydrogen sulphide attacks it at above 150°, with formation of acetylene and sodium hydrosulphide. Nitrous oxide and nitric oxide have no action at the ordinary temperature, but the former at 270° and the latter at 150° convert the carbide, with incandescence, into sodium carbonate and carbon. Mixtures of the carbide with oxidising agents are very sensitive to shock and friction. When triturated with several metallic chlorides or iodides, it becomes incandescent, often with explosion. Phosphorus chloride, aluminium chloride, and ferric chloride react with it violently. Mercuric sulphate, yellow mercuric oxide, and lead sulphate are reduced when triturated with it.

Alkylic iodides and bromides attack the carbide at about 180°, yielding symmetrical acetylenes, $RC{\vdots}CR$, if the iodide or bromide is stable at the temperature of the reaction, but a sodium salt, acetylene, and an olefine if the iodide or bromide is unstable. Monobromobenzene has no action on it at 180°.

Sodium carbide reacts with many organic compounds. Primary and secondary alcohols yield acetylene and a sodium alkyloxide. With aldehydes, ketones, and ethereal salts, there is a violent reaction, and acetylene is likewise liberated. Anhydrides and acid chlorides decompose the carbide when heated.

Sodium carbide has very much greater chemical activity than calcium carbide, and its reactions with inorganic compounds are almost always violent, carbon being liberated and the sodium behaving as if it were in the free state. C. H. B.

Ammonium Peroxide. By PETR. G. MELIKOFF and L. PISSARJEWSKY (*Ber.*, 1898, 31, 152—154. Compare this vol., ii, 161).—A better yield of ammonium peroxide is obtained when an ethereal solution of hydrogen peroxide is added at once to an ethereal solution of ammonia. When placed in a freezing mixture of snow and calcium chloride, crystals of the compound $(NH_4)_2O_2 + H_2O_2 + H_2O$ are deposited. This compound is unstable, and readily deliquesces at the ordinary temperature, first yielding ammonia and hydrogen peroxide, after which a rapid evolution of oxygen begins, and a small amount of ammonium nitrite is formed. Aqueous solutions of the compound also decompose in a somewhat similar manner. Solid ammonium peroxide readily abstracts carbonic anhydride from the atmosphere; it dissolves in alcohol, less readily at $-30°$ than at the ordinary temperature, but is practically insoluble in light petroleum at $-30°$. It reacts with manganese peroxide in the same manner as hydrogen peroxide does, and dissolves in peruranic acid, yielding the compound $(NH_4)_2O_2(UO_4)_2$.

In one case, crystals of the composition $(NH_4)_2O_2 + H_2O_2 + \frac{1}{2}H_2O$ were obtained. J. J. S.

Fusion in the Electric Furnace. By GIUSEPPE ODDO (*Real. Accad. Linc.*, 1896, [v], 5, i, 361—364).—The author has investigated the effect of heating lime with varying proportions of silica in the electric furnace, using an alternating current of 40 volts and 120 ampères. On heating granular lime, which readily combines with water, alone, a mass of crystalline scales is obtained; lime in this condition does not slake until after 2—3 days' contact with water.

On heating a mixture of lime and silica in molecular proportion, a crystalline mass of calcium metasilicate, $CaSiO_3$, is obtained, which yields gelatinous silica with hydrochloric acid, and does not set when ground and mixed with water, either alone or with lime. A mixture in the proportion of $2CaO : SiO_2$ is more refractory in the furnace, but ultimately yields a compact, crystalline mass of calcium orthosilicate, Ca_2SiO_4, which, when preserved in a desiccator, disintegrates spontaneously to a white, amorphous powder; the salt gives gelatinous silica with hydrochloric acid, and does not set with lime. On heating a mixture in the proportion of $3CaO : SiO_2$, a crystalline mass is obtained which spontaneously disintegrates like the orthosilicate, and has approximately the composition Ca_2SiO_4,CaO; the disintegrated mass is a mixture of the orthosilicate with lime. The material does not set with lime, and gives gelatinous silica with hydrochloric acid. Similar results are obtained with mixtures of the composition $6CaO : SiO_2$.

These experiments indicate that when silica is heated with excess of lime, combination only occurs in the proportions necessary to yield calcium orthosilicate. W. J. P.

Solubility of Strontium Salts, especially of the Sulphate. By JULIUS WOLFMANN (*Chem. Centr.*, 1897, i, 632; from *Österr. Zeit. Zucker-Ind. w. Landw.*, **25**, 986—996).—The author has determined the solubility of freshly precipitated strontium sulphate in water and in solutions of the sulphates, chlorides, and nitrates of the alkalis and alkaline earths, and in solutions of salts of the alkalis with strong organic acids. For temperatures above 100°, a steam boiler which would withstand a pressure of 6 atmospheres was used. At the higher pressures, strontium sulphate probably suffers partial decomposition into sulphide. The various results are tabulated and also represented by curves. E. W. W.

Action of Zinc and Cadmium Hydroxides on Ammonium Sulphate. By JULIUS TROEGER and E. EWERS (*Arch. Pharm.*, 1897, **235**, 644—646).—When sodium hydroxide is added to a solution of cadmium sulphate containing small amounts of free sulphuric acid, cadmium hydroxide is formed, whereas ammonium hydroxide causes no precipitation, due to the fact that cadmium ammonium sulphate is formed. It is best prepared by digesting freshly precipitated cadmium hydroxide in ammonium sulphate solution, filtering, and evaporating to crystallisation.

Zinc ammonium sulphate is formed when zinc hydroxide is subjected to similar treatment. A. W. C.

Variations in the Composition of Red Lead. By DURAND WOODMAN (*J. Amer. Chem. Soc.*, 1897, **19**, 339—341).—The author finds that the actual amount of red lead in different samples of this substance varies from 41 to 92 per cent. The large amount of lead monoxide sometimes present is easily separable by the lead acetate treatment, and has therefore no part in the chemical constitution of red lead; it appears to be simply an admixture and forms a measure of the incompleteness of the roasting or oxidising process. A. W. C.

Correction [Lead Iodide]. By WILDER D. BANCROFT (*J. Physical Chem.*, 1897, **1**, 786).—Lead iodide has been alluded to in the author's paper and that of Talmadge (this vol., ii, 64, 72) as crystallising with 2 molecules of water, but this, as pointed out by Roozeboom, is incorrect, as lead iodide crystallises from water in the anhydrous form. H. C.

Colloidal and Crystalline Copper Hydroxide. By JACOBUS M. VAN BEMMELEN (*Chem. Centr.*, 1897, i, 279; from *A. néer.*, **30**, 1—24).—By precipitating dilute solutions of copper sulphate with dilute alkalis and washing quickly, according to Spring and Lucion's directions (Abstr., 1893, ii, 210), blue or green precipitates of the hydroxide are obtained from which the whole of the water is only with difficulty expelled. Measurements of the vapour tension attained when the precipitate is kept over sulphuric acid of various concentrations, showed that water is continually given off until the composition of the hydroxide corresponds with the formula CuO,H_2O. There is no change in the continuity of the curve obtained by plotting out the results, which would indicate the existence of a hydroxide, $CuO,2H_2O$, as assumed by Spring and Lucion, although this second molecule of water is somewhat obstinately retained by the precipitate. The process is not reversible, for although the dehydrated precipitates take up water on exposure to moist air, the same states of hydration are not attained under like conditions of vapour tension as in the former process. The fact that the speed of dehydration cannot be represented by a simple formula, is best explained by assuming that the water is held by the oxide or the hydroxide, CuO,H_2O, by adsorption. The adsorbing substance, the hydroxide, CuO,H_2O, gradually undergoes a molecular rearrangement, so that its capacity for adsorbing water is altered. Spring and Lucion have proved that such a change occurs even under water. The crystalline hydroxide prepared by Becquerel, Böttger, and others has the composition CuO,H_2O, and is stable in presence of salts and at high temperatures. The author has prepared an amorphous hydroxide of the same composition, whose stability and power of retaining water are very similar to those of the crystalline hydroxide. E. W. W.

Cuprous Sulphate. By J. ALEXANDRE JOANNIS (*Compt. rend.*, 1897, **25**, 948—950).—When carbonic oxide is passed into a solution of cupric sulphate containing finely divided copper, or a sheet of platinum coated electrolytically with copper, the gas is slowly absorbed and the liquid becomes colourless. If now the solution is placed in a vacuum, it loses carbonic oxide (free from carbonic anhydride), and when the pressure of this gas in the apparatus falls to 2 or 3 mm., a pellicule of copper separates at the surface of the liquid and the liquid becomes blue. If carbonic oxide is again passed into the liquid, the copper gradually redissolves and the blue colour disappears.

When carbonic oxide is passed into an ammoniacal solution of cupric sulphate containing finely divided copper, the solution becomes colourless, but comparatively little copper dissolves. The whole of the dissolved carbonic oxide cannot be extracted in a vacuum, but part remains in the liquid as ammonium carbonate. There is no separation of metallic copper, and the solution remains colourless. Even in absence of metallic copper, ammoniacal solutions of cupric sulphate are slowly decolorised by carbonic oxide, and then behave in the manner just described. It would seem that, in these cases, cuprous sulphate exists in the solution in combination with ammonia, whilst in the cases first described it exists in combination with carbonic oxide. C. H. B.

Interaction of Hydrogen Sulphide and Copper Salts. By JOHN B. COPPOCK (*Chem. News*, 1897, **76**, 231—232. Compare Abstr., 1896, ii, 562, and Brauner, *ibid.*, 648).—The author has obtained cupric sulphide by adding a solution of copper sulphate acidified with nitric acid to a solution of hydrogen sulphide, but nevertheless admits that, under ordinary circumstances, cupric sulphide is not always obtained by the action of hydrogen sulphide on solutions of copper salts; he, however, does not agree with Brauner's view, that the precipitates consist of mixtures of cuprous and cupric sulphides, but regards them as belonging to the class of compound represented by Linder and Picton (Trans., 1892, 114) by the general formula nCuS,H_2S. D. A. L.

Elementary Nature of the Substance called Cerium. By Grégoire Wyrouboff and Auguste V. L. Verneuil (*Compt. rend.*, 1897, **125**, 950—957).—The authors criticise the results of Schützenberger and of Boudouard (this vol., ii, 164), and consider that the variations observed in the molecular weight of the oxides must be attributed to the presence of impurities. Cerium acetate, for example, is known to be *completely* precipitated by hydrogen peroxide. They also point out that a cerium which Boudouard found to have the atomic weight 91·8, yielded, on further treatment, two fractions with atomic weights of 93·8 and 92·2 respectively, both of which are higher than the original number. C. H. B.

Analysis of an Iron Rail from an Unused Coal Mine. By Henry P. Talbot and A. G. Woodman (*J. Amer. Chem. Soc.*, 1897, **19**, 9—12).—The section of the cast-iron rail examined was taken from the Hub mine at Glace Bay, Cape Breton, where it had lain immersed in water for over twenty years; it had lost its initial density and strength, could be easily cut into fragments, and consisted of an inner core, grey, and very soft, and an outer core, which was black and relatively hard. The following analyses were made.

	Sp. gr.	Loss on ignition.	Total iron.	Total silicon.	Total phosphorus.	Total sulphur.	Graphitic carbon.
Outer shell ...	2·45	7·50	42·00	5·85	3·60	4·65	9·50
Inner shell ...	2·16	8·75	38·10	10·60	3·75	1·41	16·00

Small amounts of manganese and aluminium were also found.

No opinion is offered as to the probable combinations of the constituents, nor as to how the changes in composition have been brought about, but it is interesting to note that articles of steel and wrought iron exposed to the same conditions as this cast-iron rail had apparently suffered no change. A. W. C.

An examination of the action of water of the Hub mine on cast-iron has been recorded by Durkee (Abstr., 1897, ii, 213). A. W. C.

Salts of Ferric Acid. By Ludwig Moeser (*J. pr. Chem.*, 1897, [ii], **56**, 425—437).—An account of these has already appeared elsewhere (Abstr., 1896, ii, 250). C. F. B.

Fluorides, Fluoro- and Fluoroxy-salts of Cobaltammonium Compounds. By Arturo Miolati and G. Rossi (*Real. Accad. Linc.*, 1896, [v], **5**, ii, 183—190 and 223—227).—*Lueotcobaltic fluoride*, $Co(NH_3)_6F_3,3HF$, may be obtained by treating luteocobaltic chloride with silver oxide or carbonate dissolved in dilute hydrofluoric acid and filtering, or by dissolving luteocobaltic chloride in hydrofluoric acid; after concentration, the solution is precipitated by alcohol. It crystallises in small, yellow prisms, is very soluble in water, and although stable at 100°, loses 3HF at 105°. Determinations of its electrical conductivity in aqueous solution at 25° show that the values of μ are nearly the same as those for potassium hydrogen fluoride; being somewhat lower at low values of v and slightly higher at high values of v; this slight abnormality is doubtless due to hydrolytic dissociation.

Luteocobaltic fluoroborate, $Co(NH_3)_6F_3,3BF_3,HF$, is prepared by adding a solution of luteocobaltic carbonate to a hydrofluoric acid solution of boric acid; it can be recrystallised from water containing hydrofluoric acid, and is stable at 110—120°.

Luteocobaltic fluosilicate, $Co(NH_3)_6F_3,2SiF_4$, is obtained by adding hydrofluosilicic acid to a solution of luteocobaltic carbonate or fluoride.

Luteocobaltic fluorotitanate, $2Co(NH_3)_6F_3,3TiF_4,2HF$, prepared by adding a solution of luteocobaltic carbonate or fluoride to a hydrofluoric acid solution of titanic acid, can be crystallised from water containing hydrogen fluoride and loses this gas at 110°. After long preservation in a desiccator over sulphuric acid, it assumes the composition

$$2Co(NH_3)_6,3TiF_4.$$

Luteocobaltic fluoroxymolybdate, $Co(NH_3)_6F_3,2MoO_2F_2$, is obtained by adding luteocobaltic fluoride to a hydrofluoric acid solution of molybdic acid; it is crystallised from dilute hydrofluoric acid, and loses weight at 110°. The analyses indicate a tendency to form a compound with hydrogen fluoride.

Luteocobaltic fluoroxytungstate, $Co(NH_3)_6F_3,2WO_2F_2$, prepared in like manner, is stable at 110°.

Luteocobaltic fluoroxyuranate is obtained by precipitating a solution of ammonium fluoroxyuranate with luteocobaltic fluoride; it probably has the composition $Co(NH_3)_6F_3,UO_2F_2$.

Luteocobaltic fluoroxyvanadate, $2Co(NH_3)_6F_3,5VO_2F_2,7HF$, separates on adding luteocobaltic fluoride or carbonate to a hydrofluoric acid solution of ammonium metavanadate and is one of the least stable of this class of salts.

The authors point out that a close analogy exists between the luteocobaltic salts, on the one hand, and the salts of the alkalis, on the other.

W. J. P.

Constitution of Inorganic Compounds. XI. Complex Cobalt-ammonia-compounds. By ALFRED WERNER (*Zeit. anorg. Chem.*, 1898, **16**, 109—166)—The insoluble sulphate (fusco-sulphate) obtained by Vortmann (*Monatsh.*, **6**, 412) by the oxidation of ammoniacal solutions of cobalt nitrate, is a mixture of two salts, oxodi-imido-octamminedicobalt sulphate and hydrosulphatoimido-octamminedicobalt sulphate.

[With FREDERICK BEDDOW].—Vortmann's fusco-sulphate is most advantageously prepared as follows. Cobalt nitrate (150 grams) dissolved in water (50 grams) is mixed with ammonia (500 grams), the solution gradually heated to boiling and at once filtered; the filtrate is divided into 10 parts, which are placed in flasks and treated with a slow current of air as long as oxycobalt nitrate is precipitated; the dark brown solution is allowed to remain 12 hours, and then filtered and acidified with dilute sulphuric acid. After a few hours, the precipitate of fusco-sulphate and aquopentammine sulphate is separated by filtration and washed with water until all the aquopentammine sulphate is removed. 200 grams of cobalt nitrate yield 7—7·5 grams of fusco-sulphate. The yield, however, varies considerably in each experiment.

Oxodi-imido-octamminedicobalt salts.—The *chloride*,

$$O[NH{:}Co_2(NH_3)_8]_2Cl_8 + 6H_2O,$$

is obtained by triturating Vortmann's fusco-sulphate with concentrated hydrochloric acid, whereby it is separated into its two constituents, the above chloride remaining insoluble as a dark green powder; the latter is dissolved in the smallest quantity of water, and the solution filtered into concentrated hydrochloric acid, when the salt crystallises in green, microscopic prisms. It is very easily soluble in water, decomposes and becomes brown when allowed to remain for a short time in neutral solutions, but is more stable in acid solution, and gives characteristic precipitates with potassium ferrocyanide, sodium sulphate, sodium phosphate, potassium dichromate, and platinic chloride. The *bromide*, with $6H_2O$, obtained in a similar manner to the chloride, crystallises in microscopic, dark green prisms. The *sulphate*, $O[NH{:}Co_2(NH_3)_8]_2(SO_4)_4 + 6H_2O$, obtained by adding dilute sulphuric acid to a solution of the chloride, bromide, or nitrate, is a greenish-grey, microcrystalline precipitate, insoluble in water, but soluble in concentrated sulphuric acid, from which it is precipitated unchanged by dilution with water. The *nitrate*, with $2H_2O$, is obtained by treating Vortmann's fusco-sulphate with concentrated nitric acid; on diluting with water, a dark green solution is obtained, and a violet-red, insoluble salt; on mixing the aqueous solution with concentrated nitric acid, the nitrate is precipitated. It crystallises from acidified water in beautiful, dark green prisms, is very soluble in water, and decomposes in neutral solutions with evolution of ammonia and precipitation of cobalt oxide; when heated at 100°, it does not give off its water of crystallisation. The *nitrate*, with $6H_2O$, obtained by precipitating a well cooled solution of the preceding salt with a small quantity of nitric acid, crystallises in silky, olive-green needles. When this nitrate is heated with an aqueous solution of ammonium carbonate, a dark brown salt is deposited, which has the composition of a basic tetrammine salt. It is sparingly soluble in cold water, easily so in warm water acidified with acetic acid, and crystallises in black, flat prisms; a salt which is probably identical with this is obtained on treating the nitrate with ammonia. Imido-octamminedicobalt chloride is obtained from the preceding green nitrate as follows. The green nitrate is warmed with a concentrated aqueous solution of sulphurous acid until it becomes red, the cold mixture is treated with a few drops of nitric acid, and the violet precipitate which is obtained is triturated with concentrated hydrochloric acid; the product is then dissolved in water, the hot filtered solution mixed with concentrated hydrochloric acid, warmed on the water bath for a short time, cooled, and mixed with an equal bulk of 90 per cent. alcohol. After being allowed to remain for 18 hours, the imido-octammine chloride separates as a dark red precipitate.

[With ANTON BASELLI.]—*Hydrosulphatoimido-octamminedicobalt salts.*—The *nitrate*, $[NH{:}Co_2(NH_3)_8SO_4H](NO_3)_3$, is obtained by treating Vortmann's fusco-sulphate with fuming nitric acid, and, after allowing the mixture to remain for an hour, washing the violet precipitate with water, this operation being repeated three times; the precipitate is then washed with water until the wash water becomes violet-red, and the product recrystallised from dilute nitric acid; it cannot, however, be completely purified by this means. In order to obtain the pure salt, the crude product is converted into the nitrate chloride (described below), dissolved in the smallest quantity of water, and precipitated with nitric acid; it crystallises in small, violet leaflets, is only sparingly soluble in cold water, and decomposes when heated on the water bath, especially in the absence of free acid. The sulphuric acid contained in this salt cannot be detected by a direct method. The *nitrate chloride*, $[NH\colon Co_2(NH_3)_8SO_4H]Cl_2NO_3$, is obtained by dissolving the crude nitrate in hydrochloric acid on the water bath, filtering as quickly as possible, and cooling the filtrate with ice and salt, the crystalline product being washed free from acid with water and with alcohol, and dried on a porous plate over sulphuric acid. It crystallises in slender, microscopic, violet needles, easily soluble in water, and when warmed with hydrochloric acid and water is converted into the imido-octamminedicobalt salt. The aqueous solution gives characteristic precipitates with several metallic salts. The *sulphate*, $[NH\colon Co_2(NH_3)_8SO_4H]SO_4,SO_4H$, is obtained by heating the preceding chloride on the water bath with concentrated sulphuric acid as long as hydrogen chloride is evolved, and then pouring the mixture into ice-cold water; it is a heavy, purple, microcrystalline powder, almost insoluble in water, decomposes when warmed with water, and has an acid reaction towards litmus. The *bromide*, $[NH\colon Co_2(NH_3)_8SO_4H]Br_3$, obtained by treating the nitrate or sulphate with hydrobromic acid, crystallises in silky, bright-violet needles; the *iodide* is a dark brown crystalline precipitate, obtained on adding sodium or potassium iodide to a solution of the nitrate chloride.

Imido-octamminedicobalt salts.—The *chloride*, $NH\colon Co_2(NH_3)_8Cl_4 + 5H_2O$, obtained by heating the chloride of the preceding sulphato-series with hydrochloric acid on the water bath and then precipitating with alcohol, crystallises in small, blood-red, lustrous prisms; it dissolves slowly in cold, more readily in warm water, decomposes when heated at 100°, and gives characteristic precipitates with many metallic salts. It is also obtained by rubbing Vortmann's fusco-sulphate with fuming hydrochloric acid and precipitating the clear solution with alcohol. The *nitrate*, with $1H_2O$, obtained by treating a solution of the chloride with silver nitrate, crystallises in long, microscopic, red prisms, is less soluble than the chloride, and decomposes in neutral aqueous solutions at 100°. The *sulphate*, with $3H_2O$, obtained by precipitating a solution of the chloride with sulphuric acid, crystallises in microscopic, brownish-red leaflets, and is insoluble in water. The *bromide*, with $5H_2O$, obtained by treating the sulphate with hydrobromic acid, crystallises in dark, blood-red prisms, and is very similar to the chloride.

Hydronitrito-imido-octamminedicobalt salts.—The *nitrate*,

$$[NH\colon Co_2(NH_3)_8NO_2H](NO_3)_4 + H_2O,$$

is obtained by treating the oxodi-imido-octammine nitrate suspended in water and nitric acid with a concentrated solution of sodium nitrite, and recrystallising the product from dilute nitric acid; it is also obtained by treating the imido-octamminedicobalt nitrate in a similar manner. It crystallises in flat, orange-coloured needles, is precipitated from its aqueous solution by concentrated nitric acid or silver nitrate, and yields characteristic precipitates with many metallic salts. The *chloride*, with $1H_2O$, obtained by triturating the nitrate with concentrated hydrochloric acid, crystallises in rhombic tablets, is very soluble in water, and is precipitated by hydrochloric acid. The *sulphate*, with $1H_2O$, which is quantitatively precipitated by adding dilute sulphuric acid to a solution of the nitrate or chloride, forms small, orange crystals, is insoluble in water, dissolves easily in concentrated sulphuric or hydrochloric acid, and is reprecipitated by dilution with water as sulphate or chloride respectively.

Preparation of the Melanochloride.—Cobalt chloride (50 grams) dissolved in boiling water (30 c.c.) is treated with ammonia (250 c.c. sp. gr. = 0 927), the mixture heated to boiling, and filtered; the filtrate is left in basins for 24 to 36 hours, the red crystalline deposit filtered off, and the filtrate mixed with hydrochloric acid (150 c.c.); a yellowish-brown precipitate is obtained which is separated by filtration, and the dark violet filtrate is allowed to remain in a cool place for 6 hours, when a black, crystalline crust is formed; this is a mixture of salts, consisting of dichloro-aquotriamminecobalt chloride, melanochloride, and the chloride of a new green salt. The last two salts are sparingly soluble, and are obtained as a grey residue when the mixture is treated with water; the bulk of the grey salt is found in the brown precipitate obtained as mentioned above by the addition of hydrochloric acid, and is separated by washing this precipitate with water. When the grey mixture is treated with a hot solution of silver nitrate containing nitric acid, the filtrate, on cooling, deposits dark red crystals of the nitrate of the melano-series. From the mother liquor, a dark green nitrate is obtained which crystallises in large leaflets.

[With FR. STEINITZER.]—*Imidohexamminedicobalt salts* (melanosalts).—The *nitrate*, $NH[Co(NH_3)_3(NO_3)_2]_2 + 4H_2O$, prepared as described above, crystallises from water acidified with nitric acid in red, quadratic prisms. It yields a violet sulphate with concentrated sulphuric acid, is not attacked by concentrated nitric acid in the cold, and is completely converted into the corresponding bromide and iodide by hydrobromic or hydriodic acid respectively. The *chloride*, obtained by precipitating an aqueous solution of the nitrate with hydrochloric acid, is a lustrous, greyish-black powder only very sparingly soluble in cold water and has an acid reaction; it dissolves in warm water, and when the solution is heated decomposes, cobalt hydroxide being precipitated. It reacts very easily with silver nitrate, nitrite, and sulphate, yielding the corresponding salts. The *bromide* is a fine, dirty green powder, sparingly soluble in cold water and decomposed by warm water; the *iodide* is a bright brown powder, and is very similar to the bromide.

Hydronitrito-imidohexamminedicobalt salts.—The *chloride*,

$$[NH{:}Co_2(NH_3)_6HNO_2]Cl_4 + H_2O,$$

is obtained by heating the preceding imidohexammine chloride, dissolved in dilute hydrochloric acid, with sodium nitrite; the filtered solution is then mixed with an equal volume of concentrated hydrochloric acid and boiled, when the salt is deposited in brownish-red leaflets.

E. C. R.

Constitution of Cobalt, Chromium, and Rhodium Bases. By SOFUS M. JÖRGENSEN (*Zeit. anorg. Chem.*, 1898, **16**, 184—197).—*Basic* *diaquotetramminecobalt sulphate*, $Co(NH_3)_4(OH_2)_2 \cdot OH \cdot SO_4$, is obtained by dissolving the chloraquotetrammine sulphate in ammonia, and then precipitating with 95 per cent. alcohol, and also in a similar manner from diaquotetrammine cobalt sulphate. It crystallises in small, red tablets, does not give up its water when dried over sulphuric acid, but loses $1H_2O$ when heated at 100°, and is converted into the anhydro-salt, which again takes up $1H_2O$ when treated with water or when allowed to remain exposed to the air, yielding the hydroxyloaquotetrammine sulphate. Basic diaquotetramminecobalt sulphate dissolves somewhat sparingly in water and yields a faintly alkaline solution, which becomes strongly alkaline after a time, owing to the evolution of one-eighth of its ammonia; it then deposits blackish-brown crystals of the anhydrobasic tetramminediaquodiamminecobalt sulphate. The basic diaquotetrammine sulphate, which is easily soluble in dilute hydrochloric acid, gives the characteristic reactions for diaquotetrammine salts; when warmed with hydrochloric acid, it is completely converted into the chloraquotetrammine chloride. After drying at 100°, it is almost insoluble in water and dilute hydrochloric acid, and when warmed with the latter yields chloraquotetrammine chloride.

Anhydrobasic tetramminediaquodiamminecobalt Salts.—The *chloride*, $OH \cdot Co[Cl(NH_3)_2(OH_2)_2] \cdot O \cdot CoCl \cdot (NH_3)_4Cl$, is obtained by dissolving chloraquotetrammine chloride in dilute ammonia, and after allowing the mixture to remain in a closed flask for 24 hours, precipitating it with 95 per cent. alcohol; it crystallises in small, hexagonal tablets which are deep violet and almost black, it is easily soluble in water, but after a time the solution decomposes, a dark grey, amorphous precipitate being formed. The freshly prepared solution yields characteristic precipitates with many metallic salts. When boiled with water, it does not give off oxygen, and is not therefore an oxycobalt salt. It is decomposed when gently warmed with hydrochloric acid (1 : 1) and yields chloraquotetrammine chloride, cobalt chloride, chlorine, ammonium chloride, and water; this decomposition is analogous to the decomposition of rhodosochromium chloride. When heated with a mixture of hydrochloric acid (2 vols.) and water (1 vol.), it is almost completely converted into the praseochloride. The *sulphate* can be obtained by treating chloraquotetrammine sulphate with ammonia or sodium hydroxide, by treating the chloride with ammonium sulphate or by treating the diaquotetrammine sulphate with ammonia. It crystallises in lustrous, black, rhombic tablets, is very sparingly soluble in water, and when dried in the air contains $5H_2O$, which it loses over sulphuric acid; no further loss takes place on heating at 100°, and the dry salt, when treated with water, again takes up $5H_2O$ without the slightest alteration in appearance. When warmed with dilute sulphuric acid, it evolves oxygen, and it can oxidise a quantity of oxalic acid corresponding to 1 atom of oxygen for 1 molecule of the salt. The *nitrate* crystallises in microscopic, brown needles; the *dithionate*, *platinochloride*, and *fluosilicate*, are also described. E. C. R.

Electrolytic Deposition of Nickel. By FRITZ FOERSTER (*Zeit. Elektrochem.*, 1897, 4, 160—165).—Tough, lustrous deposits of nickel of any thickness can be obtained by the electrolysis of aqueous solutions of the sulphate or chloride at temperatures between 50° and 90°; the deposition is most easily effected from neutral solutions of the sulphate, which may contain from 30 to 100 grams of nickel per litre. The impure nickel anodes are enveloped in parchment paper to retain the insoluble impurities and the electrolyte stirred by air or carbonic anhydride. Lustrous deposits, varying in colour from light grey to tin-white, are obtained with current densities between 0·5 and 2·5 ampères per sq. dcm., but the results are better with the higher current density. With a cathode between two anodes about 4 cm. from it and a current density at the cathode of 1·5 ampère per sq. dcm. the E. M. F. required is 1 volt at 60°. Of the impurities contained in the nickel anodes, carbon, silicon, copper, and manganese are entirely absent from the deposited metal, which, however, contains iron and cobalt in nearly the same proportions as the original, unrefined material. Special experiments showed that iron and cobalt are deposited somewhat more readily than nickel, a result not in accordance with previous determinations which show iron and cobalt in solutions of their sulphates to be slightly more electro-positive than nickel. Iron and cobalt may be quantitatively separated from nickel by the electrolysis of an alkaline solution containing a tartrate, the nickel remaining dissolved. Pure iron is deposited readily in coherent, compact form from a solution of ferrous sulphate containing 10 grams of iron in 100 c.c. at 80°, with a current of 2 ampères per sq. dcm.; the process is, however, soon brought to an end by the formation of basic ferric salts.

A solution of nickel chloride containing 5 to 12 grams of nickel and 0·25 gram of hydrochloric acid in 100 c.c. gives similar results to the sulphate. Temperatures from 50° to 90° and current densities from 0·7 to 3 ampères per sq. dcm. are used, the best results being obtained with the higher temperatures and current densities. Organic materials cannot be used to surround the anode; a piece of linen was used in one experiment, and a dark grey, brittle deposit obtained of about one-half the weight expected and containing 0·6 per cent. of carbon. The solution had a caramel-like smell, owing to organic materials, similar to those observed by Coehn in the electrolysis of strong sulphuric acid with carbon electrodes, having passed into it. It is probable that the commercial electrolytic nickel is obtained by a process similar to those described above.

The deposition of nickel from a solution of the chloride, using carbon anodes, yielded, at first, good results. The yield of metal, however, soon fell off, dark coloured, carbonaceous masses appearing at the cathode, and the solution assuming the caramel-like smell above referred to. The carbon used was the ordinary pressed carbon; possibly better results would be obtained with lead peroxide anodes.

T. E.

Atomic Weight of Nickel. By THEODORE W. RICHARDS and ALLERTON S. CUSHMAN (*Zeit. anorg. Chem.*, 1898, **16**, 167—183).—The authors have calculated the atomic weight of nickel from the ratio of silver and silver bromide to nickel bromide. Nickel bromide is prepared by heating finely divided nickel at a red heat in a current of dry bromine vapour, and then subliming the product at a bright red heat; the sublimed bromide is insoluble in cold water, but dissolves in hot water, and when free from oxide yields a clear solution, which does not give off bromine even when boiled. The sp. gr. = 4·64. The bromide is obtained quite free from oxide by subliming it in a porcelain tube in a current of dry nitrogen and hydrogen bromide, but special precautions have to be taken to exclude oxygen and moisture. The nickel employed in these experiments is purified as follows. The acid solution is subjected to a fractional precipitation with hydrogen sulphide and the nickel sulphide is extracted with dilute hydrochloric acid, washed, dissolved in hot concentrated hydrochloric acid, evaporated to dryness, and the residue dissolved in water; any cobalt which may be present is then separated by fractional precipitation of the solution with sodium hydroxide. The nickel oxide is dissolved in hydrobromic acid, converted into the ammonia compound $NiBr_2,6NH_3$, and this, after recrystallisation, decomposed by boiling with water, the resulting nickel oxide being reduced to nickel in a current of dry ammonia. The nickel is then converted into bromide by the above method and sublimed. Another sample of nickel obtained by the Mond, Langer and Quincke process was purified by fractional electrolysis.

The analysis of the pure bromide is effected as follows. The sample is dried by heating at 400° in a current of nitrogen and hydrogen bromide, allowed to cool in a current of dry nitrogen, and the nitrogen displaced by dry air. The method of weighing and the apparatus employed are similar to those which the authors employed for weighing magnesium chloride when determining the atomic weight of magnesium. The weighed sample of bromide is dissolved in an Erlenmeyer's flask in warm water, precipitated with the calculated quantity of silver nitrate, and the exact point of precipitation determined in the usual way by means of N/100 solutions of silver nitrate and hydrogen bromide; a slight excess of silver nitrate is then added, and the precipitate of silver bromide separated and weighed.

The first series of seven experiments gave as the atomic weight Ni = 58·680. The second series of seven experiments gave Ni = 58·690. The third series of seven experiments gave Ni = 58·691. (O = 16·00; Ag = 107·93). When O = 15·88, the mean of the results gives Ni = 58·25.

E. C. R.

Chromium Sulphide and Sulphochromites [Thiochromites]. By R. Schneider (*J. pr. Chem.*, 1897, [ii], **56**, 401—424).—*Potassium thiodichromite*, $K_2Cr_4S_7$, is obtained by fusing potassium chromate (1 part) with potassium carbonate (24 parts) and sulphur (24 parts) for 20 minutes at a bright red heat, allowing the mass to cool slowly, and washing it thoroughly but rapidly with cold water. It forms reddish to bluish-grey hexagonal plates with metallic lustre, and has a sp. gr. = 2·77 at 15°. When four times as much chromate is used in proportion to the carbonate and sulphur, or a weight of chromium hydroxide equal to this, a grey powder is left instead of crystals; prolonged washing of this powder with hot water leaves pure chromium sulphide, Cr_2S_3, as Berzelius stated long ago. Potassium thiodichromite is stable in air; it loses potassium sulphide slowly when it is washed with water; at a red heat in a current of hydrogen, it loses one-seventh of its sulphur, leaving a steel-blue compound, $K_2Cr_2S_6$, which retains the crystalline form of the thiodichromite; when heated in air, it loses sulphurous anhydride, chromium oxide and potassium sulphide remaining; aqueous potash and ammonia have little action on it; nitric acid and aqua regia decompose it with liberation of sulphur; hydrochloric acid converts it (in the absence of air), without evolution of hydrogen sulphide, into bluish-grey *thiodichromic acid*, $H_2Cr_4S_7$, which retains the form of the original crystals, decomposes into $H_2S + 2Cr_2S_3$ when it is heated in a current of carbonic anhydride, and is very unstable in air, with the oxygen of which it reacts, forming $H_2O + Cr_4S_7$; the last substance loses one-seventh of its sulphur when it is heated in an atmosphere of carbonic anhydride, and leaves very pure chromium sulphide, Cr_2S_3.

Sodium thiochromite, $Na_2Cr_2S_4$, is obtained by fusing potassium chromate (1 part) with sulphur (30 parts), sodium carbonate (15 parts), and potassium carbonate (15 parts); it forms small, thin crystals, light grey in colour with a shade of brown, and having a metallic to adamantine lustre; its sp. gr. = 2·55 at 15°. In its reactions it resembles the potassium compound described above, except that the very unstable *thiochromic acid*, formed when it is heated with hydrochloric acid in the absence of air, has the composition $H_2Cr_2S_4$, and the compound left when this oxidises in the air, or when sodium thiochromite is treated with hydrochloric acid in the presence of air, has the composition Cr_2S_4. An extremely convenient method of preparing pure chromium sulphide, Cr_2S_3, is to treat sodium thiochromite with dilute hydrochloric acid and heat the well-washed product in a current of carbonic anhydride. By shaking sodium thiochromite, suspended in water, with dilute solutions of silver nitrate, lead nitrate, and very faintly ammoniacal copper nitrate, *silver*, *lead*, and *copper thiochromites*, $Ag_2Cr_2S_4$, $PbCr_2S_4$, and $CuCr_2S_4$, were prepared; these are dark brown to black, and retain the form of the original sodium salt in the case of the silver and copper compounds; they are not acted on by water or hydrochloric acid, but nitric acid or aqua regia decomposes them with liberation of sulphur. C. F. B.

Oxides of Tungsten. By EN. D. DESI (*J. Amer. Chem. Soc.*, 1897, **19**, 213—242).—By the action of sulphuric acid on metallic tungsten under varying conditions, oxides of the formulæ WO, W_2O_3, W_4O_3, and W_5O_9 have been obtained; they are all blue substances, and the oxide W_2O_3 precipitates silver in brilliant scales from silver nitrate solution, and is decomposed by alkalis into metallic tungsten and a soluble tungstate.

Sulphurous acid acts on tungsten with production of the oxide W_5O_{14}, and reduces tungstic acid, but the lower oxides so formed are exceedingly unstable. The oxide W_3O_8, obtained by heating ammonium metatungstate to a bright red heat, or by fusing tungstic acid with potassium iodide, is a beautiful, purple substance with a yellow, metallic lustre; it is insoluble in acids and alkalis.

When tungstic acid is heated in an atmosphere of ethylene, a blue substance is formed, which, on heating, becomes rapidly oxidised to yellow tungstic acid, the weight of which is the same as that of the blue substance before ignition.

Tungstic acid is reduced to the metal by fusion with sodium, potassium, or magnesium, or with potassium chloride or bromide; with ammonium chloride, a black oxynitride of variable composition is formed, and with potassium cyanide a black oxynitride, $W_5N_8O_5$. In the last-named experiment, if the temperature is raised very high, metallic tungsten is obtained as bright, silver white globules.

On heating tungstic acid in an atmosphere of cyanogen, an oxynitride, $W_5N_3O_{11}$, is produced.

Tungstic acid is insoluble in concentrated or dilute sulphuric acid hot or cold, whereas molybdenum trioxide is very rapidly dissolved, thus affording a means of separating the two metals. A. W. C.

"The so-called Selective Action" of Potassium Cyanide for Gold. By WILLIAM A. DIXON (*Chem. News*, 1897, **76**, 281—282).—The author regards the term "selective action" as inappropriate, and points out that in the treatment of ores with solutions of cyanide, the cyanide dissolves the free metal, which is generally gold, so long as free oxygen or its equivalent is present, and subsequently any remaining cyanide attacks the compounds of the base metals; hence, when comparatively much cyanide and little oxygen is present, as in strong cyanide solutions, much base metal and little gold is dissolved, but in dilute cyanide solutions the conditions are reversed, and so also is the result, so that much gold and but little base metal pass into solution. Referring to the term "cyanicides," the author regards it only as applicable to substances that decompose cyanides, and not to substances that simply render them passive; iron, for instance, as ferric sulphate, destroys cyanides, but in the form of potassium ferrocyanide is stated to dissolve gold in the presence of oxygen in accordance with the reaction $6Au + 2K_4FeCy_6 + 2O_2 + H_2O = 6AuKCy_2 + 2KHO + Fe_2O_3$.
D. A. L.

Preparation of Ammonium and Potassium Platinobromides. By GEORGES MÉKER (*Compt. rend.*, 1897, **125**, 1029—1032).—Platinum, even when finely divided, is not attacked by fused ammonium sulphate, nor appreciably by alkali bromides, between 250 and 350°. On the other hand, the metal is rapidly attacked by a mixture of ammonium sulphate with ammonium bromide or potassium bromide, with formation of red ammonium platinobromide, which is readily separated because it is insoluble in ammonium salts. It crystallises from a hot solution in cubo-octahedra with the octahedral faces highly developed, but when deposited from a cold solution the cubic faces are by far the more prominent.

With ammonium chloride in place of bromide, the results are indefinite and unsatisfactory; with ammonium or potassium iodide, iodine is liberated. Potassium sulphate and bromide attack platinum in a similar way, but the yield is bad; and this is true also of mixtures of the sulphate and chloride. Ammonium sulphate decomposes potassium platinobromide and converts it into the potassium salt. C. H. B.

Additive Compounds of Potassium Platonitrite. By ARTURO MIOLATI (*Real. Accad. Linc.*, 1896, [v], **5**, ii, 355—360).—Potassium platonitrite slowly combines with dry, liquid nitric peroxide, yielding a green, additive *compound* of the composition $K_2Pt(NO_2)_4,N_2O_4$; the presence of a trace of water, and, therefore, of nitrous acid, causes the combination to occur very rapidly. The additive product is stable in a vacuum over calcium chloride, but not over sulphuric acid. At 150°, it yields a red compound, which gives a colourless solution in water, but is again obtained red on evaporation; the red compound is perhaps identical with Vèze's product, obtained from the platonitrite and sulphuric acid. The green substance reacts violently with water, yielding the white hydrate of potassium platonitrite; the reaction with ammonium hydrate is more violent, and yields platososemidiammine nitrite, $Pt(NH_3)_2(NO_2)_2$.

A green *substance* of the composition $K_2Pt(NO_2)_4,HCl$ is obtained by treating potassium platonitrite with cooled concentrated hydrochloric acid; on heating at 150°, it turns red, and on dissolving in a little water and evaporating, potassium monochloroplatonitrite is obtained.

W. J. P.

Mineralogical Chemistry.

Antimony in Bolivian Tin Ores: Volumetric Estimation of Antimony. By FERDINAND GAUTIER (*Actes Soc. Sci. Chili*, 1897, 7, 74—76).—It is argued that the antimony associated with cassiterite in Bolivia must be present as antimonic acid and not as sulphide [this view is, however, quite incorrect (compare this vol., ii, 121)]. Antimony is estimated volumetrically by oxidising with potassium permanganate, and then estimating, with sodium thiosulphate, the iodine which is liberated (in an acid solution) according to the equation $SbCl_5 + 5KI = I_2 + SbI_3 + 5KCl$.

L. J. S.

Cohenite in the Telluric Nickel-iron of Niakornak, Greenland. By EMIL W. COHEN (*Meddelelser om Grönland*, 1897, 15, 293—330).—An iron carbide, Fe_2C, has been described, and named chalypite, from the telluric iron of Niakornak, near Jakobshavn in north Greenland, but since cohenite, Fe_3C, has recently been determined in the very similar iron of Ovifak (this vol., ii, 83), it seemed probable that chalypite would probably be identical with cohenite.

This iron carbide was isolated from 50·2847 grams of iron by the action of dilute hydrochloric acid; the nickel-iron dissolved more quickly than meteoric irons; and there was a strong smell of hydrocarbons, but not of hydrogen sulphide. The material thus isolated (52·18 per cent.) consists of greyish-black, crystalline aggregates with good cleavage; analysis gave the results under I, agreeing with $(Fe,Ni,Co) : C = 3·084 : 1$. The portion soluble in the dilute hydrochloric acid (46·53) gave analysis II, representing approximately the composition of the nickel-iron. The insoluble residue contained carbon (0·06 per cent.) with comparatively much copper sulphide, together with silicate grains, rust, &c. (1·23 per cent.). The bulk analysis of the iron gave III; previous analyses show variations from this. (Anal. I—III by O. Sjöström).

	Fe	Ni.	Co.	Cu.	C.	P.	S.	Residue.	Total.	Sp. gr.
I.	91·60	1·25	0·37	—	6·44	0·07	—	trace	99·73	7·5124
II.	97·03	2·09	0·71	0·02	—	0·11	0·04	—	100·00	—
III.	93·64	2·00	0·48	0·07	3·72	0·19	1·13	—	101·23	7·2704

Fresh fractures of the iron show a granular structure; on etched surfaces, the resisting cohenite is seen as bright, irregular patches, and Widmanstätten figures were not observed. Iron sulphide was not seen, but its presence is shown by the analyses. The great hardness of the iron is due to the large amount of cohenite present. Embedded in the rust of the iron was a small fragment of ophitic diabase, which is quite different from the Ovifak basalt. L. J. S.

Calcite with Organic Colouring Matter. By JOHANNES FROMME (*Jahresber. Ver. Naturwiss. Braunschweig*, 1897, 10, 104—113).—The nature of the colouring matter of allochromatic minerals, for example, quartz, calcite, fluorite, &c., is often difficult to determine, and in many cases is not known. The author has examined translucent calcite of a chestnut-brown colour from veins in weathered gabbro in Radauthal, near Harzburg, in the Harz. The material is crystalline, and partly in well-developed, acute rhombohedra (−4R). Iron and manganese are absent. When heated in a closed tube, the mineral emits a penetrating odour and gives off some water; when ignited, it yields a pure white lime, and from the weight of this is calculated 99·15 per cent. of $CaCO_3$, leaving 0·85 per cent. for other volatile constituents. That organic matter is present is also shown by the reduction of potassium permanganate. The colouring matter is not extracted from the powdered mineral by water, ammonia, alcohol, ether, benzene, &c. The calcite is completely dissolved in hydrochloric acid, with emission of an asphalt-like smell, frothing, and separation of brown flocks; the filtrate is clear and of a wine-yellow colour.

The brown, flocculent material agrees in all its characters with Berzelius' apocrenic acid. When dry, it is blackish-brown and earthy; it has an astringent taste, and is slightly acid to litmus. It is only slightly soluble in water, giving a yellow solution, but it is easily soluble in alcohol and alkalis. From the ammonia solution, lime water precipitates the calcium salt as dark brown flocks. Nitrogen is absent, and in this it differs from humic and other acids. By dissolving a large quantity of calcite, 0·2310 per cent. of apocrenic acid was obtained. The colouring matter in the yellow hydrochloric acid solution of the calcite was separated by dialysis, and on evaporating, another acid was obtained in the form of brownish-black flocks; this is only sparingly soluble in water and alcohol, but readily in hydrochloric acid and alkalis. It is present in the calcite to the extent of 0·0135 per cent.

Since these substances cannot be extracted from the calcite by reagents, they must exist in combination. From a solution of calcium hydrogen carbonate containing an ammonia solution of apocrenic acid, artificial crystals of calcite were obtained; these are acute rhombohedra of a brownish-yellow colour, exactly like the natural mineral. L. J. S.

[Dolomite from the Transvaal.] By Frederick H. Hatch (*Quart. Journ. Geol. Soc.*, 1898, **54**, 73—99).—In a paper on the geology of the Witwatersrand and other districts in the Southern Transvaal, the following analysis, by G. T. Prior, is given of crystalline dolomite.

CaO.	MgO.	FeO.	MnO.	SiO_2.	$CO_2 + H_2O$.	Total.	Sp. gr.
29·61	19·71	1·35	1·18	0·94	46·69	99·48	2·88.

This corresponds with $CaCO_3$, 52·87 ; $MgCO_3$, 41·39 , $FeCO_3$, 2·17 ; $MnCO_3$, 1·99 per cent. Another specimen was found to contain 2·81 per cent. of silica, and every variation appears to exist between dolomite and chert. In the weathered rock, the siliceous ribs stand in relief, giving the surface a wrinkled appearance, hence the name "elephant rock" ; the weathered surfaces are brown, owing to the separation of the manganese as wad. L. J. S.

Datolite from Radauthal. By Johannes Fromme (*Jahresber. Ver. Naturwiss. Braunschweig*, 1897, **10**, 170—174).—Veins of datolite occur in the gabbro of Radauthal, near Harzburg, in the Harz ; it is massive with a granular structure, and is white, often with a greenish tinge. The mean of two analyses by Schwikkard is

SiO_2.	B_2O_3.	Al_2O_3 and traces of Fe.	CaO.	H_2O.	Total.	Sp. gr.
37·65	[20·36]	1·18	34·91	5·90	100·00	2·951

When the aluminium is taken as replacing boron, this agrees closely with the usual formula, $HCaBSiO_5$; the existence of the isomorphous molecule, $HCaAlSiO_5$, corresponding with euclase, $HBeAlSiO_5$, is therefore assumed. Full details of the method of analysis are given.
L. J. S.

Quartz-barytes Rock from Salem, Madras. By Thomas H. Holland (*Records Geol. Survey India*, 1897, **30**, 236—242).—This rock forms a network of veins, from mere strings to several feet across, in the pyroxenic and other gneisses near Alangayam in the Tirupatur taluk, Salem district, Madras Presidency. The average sp. gr. of the rock is 3·005, from which is calculated 69·2 per cent. of quartz, and 30·8 of barytes ; small amounts of galena, pyrites, ilmenite, hæmatite, and limonite are also present. The quartz is white to grey, and forms an aggregate of interlocking crystals. The grey to pink barytes individuals are 2—3 inches across, and are sometimes bounded by crystal faces ; analysis of crystals gave

$BaSO_4$.	$CaSO_4$.	FeO_3,Al_2O_3.	SiO_2.	Loss on ignition.	Moisture.	Total.	Sp. gr.
94·15	4·01	0·93	0·63	0·26	0·04	100·02	4·30

The low sp. gr. is due to the partial replacement of barium by calcium. This rock, which has the appearance of a pegmatite, is presumably of igneous origin ; from the magma, the barytes has crystallised, as a rule, before the quartz. Such a mode of occurrence of barytes is unique. L. J. S.

[Hornblende from Ivrea, Piedmont.] By Frank R. van Horn (*Tsch. Min. Mitth.*, 1897, **17**, 409—414).—In a petrographical paper (pp. 391—420) on the norite and related rocks from the neighbourhood of Ivrea in Piedmont, the following analysis (I) of hornblende is given. This was isolated from a hornblende-gabbro, from Pavone, containing plagioclase (near bytownite), 33; hornblende, 27; diallage, 20; hypersthene, 5; magnetite, 10, and green spinel, 5 per cent.; the bulk analysis of the rock is given under II, also trace of P_2O_5; sp. gr. = 3·18. The brown hornblende has a cleavage angle of 124° 18′, and an extinction angle on $b(010)$ of 15°; sp. gr. = 3·22. The results of the analysis (I) agree approximately with the orthosilicate formula, $R'_2R''_4R'''_2Si_4O_{16}$; the mineral, therefore, resembles the syntagmatite of Vesuvius and Jan Mayen.

	SiO_2.	TiO_2.	Al_2O_3.	Fe_2O_3.	FeO.	MnO.	MgO.	CaO.	Na_2O.	K_2O.	H_2O.	Total.
I.	39·58	trace	14·91	4·01	10·67	trace	13·06	11·76	2·87	0·62	2·79	100·27
II.	39·84	0·08	19·71	7·73	8·89	trace	7·33	13·52	1·59	0·53	0·86	100·08

L. J. S.

Phosphatic Chert. By J. H. KASTLE, JOS. C. W. FRAZER, and GEO. SULLIVAN (*Amer. Chem. J.*, 1898, **20**, 153—159).—The authors give analyses of thirty-nine samples of chert of the Lower Hudson formation, which are remarkable for the large percentage of phosphoric acid they contain. The average of the analyses is 1·684 per cent. P_2O_5, their range being from 0·179 to 3·5 per cent. P_2O_5. It thus appears that the chert contains from four to five times as much phosphoric acid as either the soil or limestone rock in the same locality.

W. A. D.

Talcose-schist from Canton Valais. By THOMAS G. BONNEY (*Geol. Mag.*, 1897, N.S., [iv], 4, 110—116).—In the schists near Zinal in the Val d'Anniviers, Switzerland, is a soft "ovenstone" which is used for constructing stoves. The dominant tint of this stone is lead-grey, inclining to a dull lavender, and the structure is fissile, with greenish-white seams. From a microscopical examination, the minerals present seem to be talc and chlorite, with grains of magnetite and pyrites. Analysis of the rock by Miss E. Aston shows that it might consist of talc, tremolite, and a chlorite, in approximately equal amounts.

SiO_2.	Al_2O_3.	Fe_2O_3.	FeO.	CaO.	MgO.	NiO.	CO_2.	H_2O.	Moisture.	Total.
44·94	5·47	1·75	3·47	8·76	25·57	2·90	1·22	5·40	0·35	99·83

Also traces of Cr_2O_3, MnO, and CuO; sp. gr. = 2·90. Other specimens contained 0·5 and 0·25 per cent. of NiO; the water and carbonic anhydride also vary. The nickel seems to be present in this rock, as well as in various Alpine serpentines, as a silicate, possibly noumeite, and not as awaruite (Abstr., 1896, ii, 611).

The examination of this rock confirms the view that a talcose-schist may be only a further stage in the alteration of a much crushed serpentine, or the third remove, at least, from a peridotite.

L. J. S.

Rocks [and Felspar] from the Volcano Osorne, Chili. By WILLY BRUHNS (*Ber. naturforsch. Ges. Freiburg i. B.*, 1897, **10**, 201—214).—A description is given of a collection of rocks, comprising mainly felspar-basalts poor in olivine, from the volcano of Osorne, in south Chili. Porphyritic crystals of felspar from one of these rocks gave analysis I, corresponding with a bytownite, Ab_1An_4. The angle of optical extinction on the basal plane is 20°; sp. gr. = 2·731. The crystals are often rich in zonally arranged enclosures, but for the analysis all impure material could be separated by the electromagnet. The bulk analysis of the rock is given under II; felspar, augite, magnetite, and brown glass are present.

	SiO_2.	Al_2O_3.	Fe_2O_3.	FeO.	CaO.	MgO.	K_2O.	Na_2O.	Total.
I.	48·52	32·01	0·63	—	16·41	trace	—	2·76	100·33
II.	54·58	23·21	5·33	2·44	11·37	0·76	—	2·69	100·38

L. J. S.

Olivinite and Picrotitanite from Magnolia District. By Milton C. Whitaker (*Proc. Colorado Sci. Soc.*, 1898, Feb. 5, 14 pp.).—The granite of the Magnolia district in Boulder Co., Colorado, is intersected by a dyke of igneous rock; the dark grey to purplish rock of this dyke contains serpentinous nodules, enclosing some olivine, magnetite, picroilmenite, garnet, calcite, chlorite, biotite, muscovite, and a zeolite. Analysis of material freed from garnet and picroilmenite gave the results under I; sp. gr. = 2·73. It is probably an altered olivine rock.

	SiO_2.	TiO_2.	P_2O_5.	CO_2.	Al_2O_3.	Fe_2O_3.	FeO.	CaO.	MgO.	K_2O.	Na_2O.	H_2O.	Total.
I.	22·07	0·34	0·60	8·77	11·86	4·67	3·35	10·48	25·39	3·64	3·29	5·61	100·07
II.	0·53	51·92	—	—	—	12·82	23·70	—	12·05	—	—	0·49	101·51

The picroilmenite occurs in this rock as black, lustrous grains and nodules; sp. gr. = 4·44. The mean of two analyses by different methods is given under II; the ferrous oxide is possibly too low. This gives $MgO,FeO,2TiO_2$, that is, an ilmenite rich in magnesia (compare this vol., ii, 122). L. J. S.

Chemical Evidence for the Existence of Organisms in the Oldest Rocks. By Charles Callaway (*Proc. Liverpool Geol. Soc.*, 1897, 8, 98—103).—Since limestones, graphite, apatite, iron ores, and even metallic sulphides may in some cases have been formed by organic agencies, it has sometimes been assumed that the presence of these in association with gneiss is evidence of the existence of organic remains in the oldest rocks. It is here pointed out that this reasoning is not sound, since these minerals can also be of igneous or of metamorphic origin. L. J. S.

Spectrographic Analysis of Meteorites. By W. Noel Hartley and Hugh Ramage (*Sci. Proc. Roy. Dublin Soc.*, 1898, N.S. 8, 703—710).—The authors, who have previously made spectroscopic examinations of iron ores (Trans., 1897, 533), have now extended their observations to meteorites; irons, siderolites, and stones of 13 falls being examined. Lines of the following elements are identified, and measurements between wave-lengths 6000 and 3200 are given: calcium, iron, nickel, cobalt, chromium, gallium, lead, manganese, silver, copper, sodium, potassium, rubidium, and magnesium. The proportions of these vary to some extent in the different meteorites.

Copper, lead, and silver are common constituents, as is also the case in iron ores and manufactured irons. Gallium is present in all the irons but not in all the stones examined. Chromium and traces of manganese are present in the stones, but as a rule not in the irons. Meteoric iron differs from telluric iron in containing nickel and cobalt in considerable amount, whilst manganese is only present in traces.

The olivine from an Atacama siderolite was found to contain sodium, potassium, magnesium, calcium, iron, nickel, chromium, copper, silver, lead, and traces of strontium and manganese. L. J. S.

Water of the "Marzis" Spring near Geneva. By C. Rust (*Arch. Sci. phys. nat.*, 1898, [iv], 5, 162—165).—Clear, colourless water from the "Marzis" spring, at Plongeon, near Geneva, gave the following results on analysis: K_2O, 0·00583; Na_2O, 0·00879; HN_3, traces; MgO, 0·02638; CaO, 0·18310; $Al_2O_3 + Fe_2O_3$, 0·00103; MnO, traces; SO_3, 0·03376; P_2O_5, 0·00019; N_2O_5, traces; Cl, 0·00939; total CO_2, 0·33685; SiO_2, 0·01308; N, 0·01327; O, 0·00658; total, 0·63825, in grams per 1000 c.c.; sp. gr., 1·000223; temperature, 9·15°. This forms a good table water, and closely resembles the medical water of the Cachat spring at Evian. L. J. S.

Comparative Examination of the Montecatini Chlorinated Waters. By Luigi Luciani, Uberto Dutto, and D. Lo Monaco (*Rend. Accad. Lincei*, 1896, [v], 5, ii, 81—93. See this vol., ii, 244).

Physiological Chemistry.

Peptic Digestion. By Wilhelm Croner (*Virchow's Archiv.*, 1897, **150**, 260—271).—A number of experiments are recorded, the object of which is to discover the relationship between the amount of pepsin and hydrochloric acid which will produce the most efficient digestion of albumin. The amount of pepsin should be over 0·1 per cent., and of hydrochloric acid between 0·05 and 0·1 per cent. W. D. H.

Influence of Alcohol on Digestion. By Russell H. Chittenden, Lafayette B. Mendel, and Holmes C. Jackson (*Amer. J. Physiol.*, 1898, 1, 164—209).—On the introduction of alcohol or alcoholic beverages into the mouth in dogs and men, the flow of saliva is transitorily increased; and on its introduction into the stomach, the gastric secretion is increased in quantity, acidity, and proteolytic activity. Alcoholic drinks retard the activity of digestive fluids, but in the living animal this is counterbalanced by the increased secretion of the juices mentioned, as well as by the rapid absorption of the alcohol given; experiments with test meals, with and without alcohol, gave practically the same results. There is little or no direct influence on pancreatic or intestinal juices. W. D. H.

Inversion of Cane-sugar in the Stomach. By S. J. Ferris and Graham Lusk (*Amer. J. Physiol.*, 1898, 1, 277—281).—The inversion of cane sugar that occurs in the stomach is very considerable, and is due to the hydrochloric acid present. Thus, in the stomach of a living rabbit, 90 per cent. was inverted in six hours and a half; this is even greater than the inversion that occurred in a beaker, using 0·2 to 0·3 per cent. hydrochloric acid, and is probably due to the continual movement of the gastric contents. W. D. H.

Influence of Borax and Boric Acid on Nutrition. By Russell H. Chittenden and William J. Gies (*Amer. J. Physiol.*, 1898, 1, 1—39).—Doses of borax up to 5 grams, even when continued for some time, have no effect on the nutritional changes of the body. Larger doses (5 to 10 grams daily) increase proteid metabolism, and larger amounts of nitrogen, sulphuric acid, and phosphoric acid are excreted in the urine.

Boric acid up to 3 grams daily has no effect. In larger doses, borax retards the assimilation of proteid and fatty food, whilst with very large doses there is a diarrhœic tendency.

Borax decreases the volume of the urine, and, passing as such into this excretion, raises its specific gravity and renders it alkaline. Both borax and boric acid are rapidly eliminated, and so no cumulative action can result from their daily use. They have no influence on putrefaction in the intestine. W. D. H.

Metabolism during Inanition. By Johan E. Johansson, E. Landergren, Klas Sondén, and Robert A. A. Tigerstedt (*Chem. Centr.*, 1897, i, 180—181; from *Skand. Arch. f. Physiol.*, 7, 29).—The experiments made on a man lasted nine days, five of which were hunger-days. The intake and output, including those in the lungs, were estimated. The average loss of weight per diem during hunger was 1·48 per cent. (Cetti, 1·54, Succi, 0·83). W. D. H.

Metabolism in Fatty Degeneration. By Graham Lusk (*Proc. Amer. Physiol. Soc.*, 1898, 5—6; *Amer. J. Physiol.*, 1).—The proteid molecule may yield 60 per cent. of dextrose in metabolism. Hence the large yield of sugar produced by phloridzin in starving animals. Experiments on dogs in which acute fatty degeneration had been produced by phosphorus poisoning, show that no sugar is present, and on giving phloridzin no excess of sugar is eliminated; either, then, the sugar is burnt as soon as it is formed, or it is converted into another substance. The former alternative is improbable on account of the high proteid metabolism, for its oxidation would reduce proteid metabolism; it is therefore probable that the sugar is converted into another substance, namely, the fat which appears within the cells of the body. W. D. H.

The Rôle of Sugar in Animal Metabolism. By Nathan Zuntz (*Chem. Centr.*, 1897, i, 248; from *Du Bois Reymond's Archiv.*, 1896, 538).—The paper combats the view advanced by Seegen and Chauveau, that sugar is the chief source of muscular energy. Fat, and a portion of the proteid, acts similarly. There is no evidence that the fat is transformed into carbohydrate before it is capable of utilisation in this way. W. D. H.

Muscular Work and Glycogen. By JOSEF SEEGEN (*Chem. Centr.*, 1897, i, 247; from *Du Bois Reymond's Archiv.*, 1896, 383, 407; 511—523).—A further contribution to a much debated subject. Experiments on dogs show that with muscular work the muscular glycogen diminishes, but only sufficiently so to account for from 3 to 11 per cent. of the work done. Sugar is regarded as the main source of energy, and this view is not regarded as antagonistic to Pflüger's. W. D. H.

The Sugar-yielding Substances of the Body. By FERDINAND BLUMENTHAL (*Chem. Centr.*, 1897, i, 938; from *Berlin. klin. Woch.*, **34**, 245—248).—The artificial production of sugar from albumin is stated to be probable, but not proved. Various nucleo-proteids, however, yield pentose. W. D. H.

Hepatic Glycogenesis. By FREDERICK W. PAVY (*J. Physiol.*, 1898, **22**, 391—400).—A further contribution to the discussion which has arisen between the author and D. Noël Paton. The evidence, both *a priori* and experimental, is regarded as being in favour of the ferment theory of the *post-mortem* change of glycogen into sugar, and against that advanced by Paton that the change is a 'vital' one due to an exaggeration of the katabolic side of metabolism. W. D. H.

Papain-proteolysis. By RUSSELL H. CHITTENDEN, LAFAYETTE B. MENDEL, and H. E. MCDERMOTT (*Amer. J. Physiol.*, 1898, **1**, 255—276).—Certain recent writers have stated that papain digestion does not yield true peptone, but the present experiments show that, although different preparations of papain vary in activity, the majority are energetic, and produce, as Martin showed, large quantities of proteose, especially deuteroproteose, and relatively a very large amount of true peptone. When injected into the circulation, these substances produce the usual physiological effects on blood-pressure, coagulability of the blood, and urinary secretion. When the deuteroproteose is injected, it appears if the kidneys are active, in the urine partly as such, partly as true peptone. This confirms a previous observation of Neumeister's.
W. D. H.

Absorption of Iron in the Intestine in its Relation to Blood-formation. By M. CLOETTA (*Chem. Centr.*, 1897, i, 393—394; from *Arch. exp. Path. Pharm.*, **38**, 161—174).—The absorption of the iron in *ferratin natr. sol.*, in loops of a dog's small intestine amounts to from 19 to 23 per cent. The amount of iron in the liver is greater when organic compounds of iron are given; it is considered probable that inorganic compounds must be first converted into iron albuminate before absorption is possible. No increase in the hæmoglobin of the blood was found. W. D. H.

Origin and Properties of Lymph. By LEON ASHER and A. G. BARBÈRA (*Zeit. Biol.*, 1898, **36**, 154—239).—The blood-vessels normally absorb a part of the tissue-juice. The lymph carries toxic products of metabolism, which, however, are capable of change, and thus of future use to the organism; lymph is not qualitatively the same as blood plasma, but is largely a product of the work of the organs, and when injected into the blood stream it produces certain characteristic effects. In the salivary glands, when secretion occurs, there is not only a change in the blood-vessels, but the flow of lymph is increased. Increased work of the thyroid increases the lymph flow from that organ. On pure proteid diet, the flow of lymph in the thoracic duct is increased; the increase here was parallel with the increase of nitrogen in the urine, that is, with the work of absorption.

Intravenous injection of crystalloid substances (like sugar) is only followed by increase of the lymph stream if there is simultaneously an increase in glandular activity. Intravenous injection of peptone causes an increase of the lymph formation by the liver, as Starling showed; but there is at the same time an enormous (eight-fold) increase in the flow of bile. The secretion hypothesis of lymph formation thus receives strong confirmation. The increase of the lymph stream which occurs when the vena cava inferior is blocked is probably also due to increase in the work of the liver.

A distinction must be drawn between "nutrition fluid" and lymph. The fluids of the serous cavities, synovia, endolymph, perilymph and aqueous humor cannot be functionally reckoned as lymph. The "nutrition fluid" is a transudation from the blood, and the tissue cells play a part in regulating the transudation. By the work of the cells of the organs, katabolic products arise which alter the osmotic relationships of lymph and blood. The changes which the blood stream undergoes during the physiological work of the organs also take a share in determining the condition of the lymph stream.

The lymphatic glands have the power of altering the katabolic products brought to them by the lymph; these products form the normal stimulus to these glands, and one result is the formation of leucocytes. The leucocytes undertake the change in the katabolic products, so that, finally, the lymph once more resembles blood-plasma; in other words, the lymph leaving the lymphatic glands on its way to the blood stream has certain differences from that contained in the different lymphatic channels to these glands. W. D. H.

Similarity of Structural Changes Produced by Want of Oxygen and by Certain Poisons. By Sidney P. Budgett (*Amer. J. Physiol.*, 1898, 1, 210—214).—The visible changes of structure shown by certain protozoa (*amœba*, *paramœcium*, &c.) when deprived of oxygen are described and figured; these may be exactly reproduced by the action of certain poisons, such as potassium cyanide. This indicates either that these poisons prevent oxidation or that lack of oxygen produces toxic substances. Potassium cyanide reduces the resistance shown by *paramœcium* to the entrance of water, and leads to the taking up of water probably by hastening molecular breakdown, and so increasing the osmotic pressure within the cell.

W. D. H.

Reduction of Arsenic Acid by Juices of Organs. By B. Binz (*Chem. Centr.*, 1897, i, 394; from *Arch. exp. Path. Pharm.*, **38**, 259—265).—Arsenious acid in a weak alkaline solution is oxidised to arsenic acid by the fresh juice of the small intestine, of the spleen, and especially of the liver. The present research is directed to determine whether any of the fluids of the body produce the opposite effect. The blood (of ox and calf) do so feebly, rabbit's liver strongly. After feeding on arsenic acid, small quantities of arsenious acid are found in the urine. Fresh rabbit's urine carries out the reduction very feebly, muscular tissue not at all, and the living small intestine feebly.

W. D. H.

Salivary Secretion. By D. F. F. GRÜNBAUM (*J. Physiol.*, 1898, **22**, 385—390).—Heidenhain stated that the percentage of salts in saliva varies directly as the rate of secretion; his own figures show, however, some discrepancies. In the present research, the submaxillary gland was made to secrete against resistance; under these circumstances, less saliva is secreted and the percentage of salts in it increases. Hence there is decrease in the amount of work done, which is greater than the increase of work in consequence of external resistance, and a rise in the organic substances of the secretion. W. D. H.

Composition of Human Saliva. By RUSSELL H. CHITTENDEN (*Proc. Amer. Physiol. Soc.*, 1898, 3—5; *Amer. J. Physiol.*, 1).—Human saliva, although ordinarily alkaline to litmus or lacmoid, is acid to phenolphthalein. The alkalinity is therefore due to alkali phosphates, acid phosphates being also present. The average numbers show an alkalinity equal to 0·14 per cent. of sodium carbonate, and an acidity such that 1 gram of saliva requires 0·06 milligram of sodium hydroxide to neutralise it. Alkalinity, acidity, and amylolytic power are greater in saliva coming from glands after a long rest, that is, collected before breakfast, than in that secreted an hour after the meal. The increased amylolytic activity is not due to the salts, but to an increase in the organic substances (including the enzyme). Alcoholic drinks increase the amylolytic activity of saliva. W. D. H.

Urine of Echidna aculeata. By RICHARD NEUMEISTER (*Zeit. Biol.*, 1898, **36**, 77—81).—The urine from the Echidna was collected from the cloaca without contamination with fæces. The animal is wholly carnivorous, and, contrary to expectation, its urine was found to be neutral in reaction. This animal has therefore the power, which is absent in the higher mammals, of being able to completely neutralise by ammonia the acid substances which originate from proteids. The urine contains no uric acid, and no alloxuric bases. Urea accounts for 81·14 and ammonia for 6·98 per cent. of the nitrogen in the urine; the remainder of the nitrogen is in some substance or substances not yet identified.

The urine of the bull frog and of the crocodile, which were likewise kept on flesh diet, is also neutral or faintly alkaline. The same is true for the tortoise (Müller and Magnus), but no details as to food are given. In a starving tortoise (Marchand), the urine was faintly acid. Nebelthau found the urine of the edible frog fed on worms to be faintly acid or neutral. W. D. H.

Physiological Action of Normal Dinitriles. By JEAN F. HEYMANS and PAUL MASOIN (*Chem. Centr.*, 1897, i, 1240—1241; from *Arch. Pharmacodynamie*, **3**, Heft 1 and 2).—The fatal doses of cyanogen, and of the dinitriles of malonic acid, of succinic acid, and of pyrotartaric acid are given in respect to frogs, rabbits, dogs, and pigeons. Speaking generally, the dose rises with the molecular weight. Sodium thiosulphate is stated to be antagonistic to the dinitriles.

W. D. H.

Physiological Action of Choline, Neurine, and allied Substances. By Frederick W. Mott and William D. Halliburton (*Proc. Physiol. Soc.*, 1898, 34—35. Compare Abstr., 1897, ii, 222).—In a previous communication, it was shown that cerebro-spinal fluid removed from cases of brain atrophy (particularly from cases of general paralysis of the insane) produces a fall of blood-pressure. The material in the fluid that produces this effect is not proteid, nor is it of inorganic nature, but is precipitable by phosphotungstic acid, and is therefore probably alkaloidal. Dilute solutions of choline hydrochloride produce the same effect on blood-pressure. The related alkaloid neurine produces a different effect, a preliminary fall of pressure being usually followed by a marked rise.

The present research shows that the substance in the cerebro-spinal fluid which produces the effect is choline, characteristic crystals of the platinochloride having been prepared from the fluid.

The fall of blood-pressure which occurs is only partly of cardiac origin. There is slowing of the heart, but this is often not very marked, and as tracings with Barnard's cardiometer showed, is accompanied with an increased output.

The main cause of the fall is vascular dilatation. This was investigated by the use of air-plethysmographs. In the case of the limbs, there is no evidence of active dilatation; the volume of the limb is, in fact, slightly diminished; this appears to be secondary to the general fall of arterial pressure. The same is true for the kidney; the lever of the kidney oncometer falls with the blood-pressure. In the case of the intestines, however, there is marked vascular dilatation. (For a description of the intestine oncometer used, see Edmunds, *J. Physiol.*, 1898, **22**, 380.)

Although the principal interest in this work centres round the fact that the toxic material in the specimens of cerebro-spinal fluid in question is choline, a good many experiments have been made on neurine as well. The primary fall in the arterial pressure is of cardiac origin; the slowing of the heart and deepening of the respiration are very marked symptoms; usually, this is followed by a rise of pressure, due to constriction of peripheral vessels. In some cases, this latter phase is absent, and the heart remains permanently slowed and the animal may die, whilst in some few cases, using small doses (1 or 2 c.c. of a 0·1 per cent. solution of the hydrochloride), there is only the second phase, a rise of pressure with peripheral constriction of the intestinal and kidney blood-vessels.

W. D. H.

Physiological Action of Derivatives of Cocaine. By Gaetano Vinci (*Chem. Centr.*, 1897, i, 1217; from *Du Bois Reymond's Archiv.*, 1897, 163—170).—It has previously been shown that eucaine acts in a manner similar to cocaine (this vol., ii, 86). The same is true for methylic 4-benzoxy-1:2:2:6-tetramethylpiperidine-4-carboxylate formed from eucaine by the substitution of a methyl group for hydrogen.

The action of trans-benzoylmethylvinyldiacetone-alkamine (4-benzoxy-1 : 2 : 2 : 4-tetramethylpiperidine) was also investigated. Although this is a local anæsthetic, it causes stimulation and hyperæmia at the place of application, produces a curare-like action on motor nerve-endings, and in large doses paralyses the vagus nerve-endings in the heart.

W. D. H.

Physiological and Therapeutic Effects of Spermine. By Alexandre Pœhl (*Compt. rend.*, 1897, **125**, 959—961).—Spermine, $C_5H_{14}N_2$, occurs in almost all the organs of the body, and even when present in small quantities accelerates the oxidation of organic and inorganic substances in the same manner as a ferment (*Compt. rend.*, 1892 and 1893). Many observers have found that when administered by ingestion or subcutaneous injection, it has beneficial effects in a very wide range of maladies. These effects the author attributes to its power of restoring or increasing intra-organic oxidations, facilitating the elimination of waste products and destroying antitoxins or toxins of microbic origin. He finds that, when it is administered, the ratio of nitrogen in the urea to the total nitrogen is restored to normal, or in other words, the injurious intermediate nitrogenous compounds are reduced in quantity. Direct experiment shows that the leucomaines and nitrogenous extractive substances in the urine diminish. The ratio of urea to chlorides also diminishes, notwithstanding the increase in the total quantity of urea; the ratio of uric acid to phosphoric acid is slowly restored to normal; the ratio of total phosphoric acid to neutral phosphates is distinctly reduced, and the consequent increase in the alkalinity of the blood is favourable to oxidation. On the other hand, spermine seems to have no influence on the intestinal fermentations, and the ratio of total sulphuric acid to sulphonic acids is not altered; it is therefore without effect on intestinal auto-intoxication.

C. H. B.

Chemical and Physiological Studies on Phloridzin and Allied Compounds. By Max Cremer (*Zeit. Biol.*, 1898, **36**, 115—127).—In animals in which phloridzin-diabetes has been produced, the urine, after removal of the sugar by fermentation, is lævorotatory. Moreover, phloridzin can be separated as such from the urine; its lævorotatory action was, therefore, attributed to phloridzin; but, if this is the case, the quantity of phloridzin in the urine as estimated by the polarimeter is greater than the quantity administered. Phloridzin is, therefore, not the only lævorotatory substance in the urine, but some of that which is given must be changed into another, more strongly lævorotatory substance. The present research considers some of the properties of phloridzin itself (solubilities, precipitants, &c.), and gives an account of the attempts to isolate and identify the more strongly lævorotatory substance. Its nature, however, is not yet determined.

W. D. H.

Phloridzin-Diabetes. By Graham Lusk (with E. L. Munson, E. A. Lawbaugh, and I. M. Heller) (*Zeit. Biol.*, 1898, **36**, 82—114). —In connection with the question whether the sugar in phloridzin-diabetes originates from proteid or fat, it is pointed out that, from the decomposition of 100 grams of proteid, 45·08 grams of dextrose could originate. The heat-value of proteid in hunger is 3·8 Cal.; of dextrose, 3·74; the quantity of sugar from proteid would therefore yield 44·1 per cent. of the heat-value of the proteid, which, in phloridzin-diabetes, would be lost to the animal. This would account for the great decomposition of proteid material in these animals. It was hoped that examination of the respiratory quotient would lead to a solution of the question as to whether fat is used up, but the numbers obtained are not sufficiently distinctive for this purpose. W. D. H.

The Experimental Production of Amyloid. By Carl Davidsohn (*Virchow's Archiv.*, 1897, **150**, 16—32).—Pure cultures of *Staphylococcus pyogenes* were injected subcutaneously every two or three days into various animals until they died, and in half the cases amyloid degeneration was found. The best results were obtained from cultures prepared from the pus from a case of tubercular empyema. The spleen and bone-marrow showed the change best; then followed liver, intestine, stomach, kidneys, salivary glands, and heart. The pus of the abscesses and the blood of sick and dead animals also contained the same substance. The histological and chemical characters of the new material are very similar to those of the amyloid found in the disease in man. A slight difference in its behaviour to iodine and sulphuric acid is regarded as comparatively unimportant, and the conclusion is drawn that the same disease is being dealt with. W. D. H.

The Experimental Production of Amyloid. By Oscar Lubarsch (*Virchow's Archiv.*, 1897, **150**, 471—481).—In attempting to produce the disease experimentally in animals, the results have been mainly negative; this is possibly due to want of virulence in the organisms used. Some importance is attached to the difference in colour reactions (especially to aniline dyes) between the artificially produced amyloid and that found in man; this is, perhaps, to be explained by the existence of a hyaline precursor of the amyloid which was found in dogs and rabbits. W. D. H.

Lecithin in Grawitz's Kidney Struma. By Gerolamo Gatti (*Virchow's Archiv.*, 1897, **150**, 417—425).—This growth of the kidney has been variously called lipoma and endothelioma, and by some is regarded as due to suprarenal residues. In order to confirm this view, the amount of lecithin was estimated in two cases, the suprarenal being rich in that substance. In the first of these, the result is regarded as unsatisfactory, because the tumour had been in formalin for a long time. The percentage of lecithin was 0·147 per cent. In the second case, the percentage was 3·47. This is regarded as confirming the view that the growth is of suprarenal origin. W. D. H.

Comparative Examination of the Montecatini Chlorinated Waters. By Luigi Luciani, Uberto Dutto, and D. Lo Monaco (*Rend. Accad. Linc.*, 1896, [v], **5**, ii, 81—93).—The principal springs of chlorinated water at Montecatini, in the Val di Nievole, are those named Tamerici, Torretta, Olivo, Savi, Regina, Acqua media, Villino, and Tettuccio; the medicinal properties of these waters have considerable reputation; they contain chlorides, and act partly as purgatives. By administering definite quantities of the waters to two of the authors and then determining the chlorides contained in the urine passed during the subsequent five hours, the ratio between the chlorides taken in the water and the chlorine eliminated by the kidneys has been ascertained. This ratio increases as the proportion of chlorides in the water decreases. W. J. P.

Toxic Action of Acetylene. By UGOLINO MOSSO and FELICE OTTOLENGHI (*Real. Accad. Linc.*, 1896, [v], **5**, ii, 324—331).—The authors have made numerous experiments on the toxic action of acetylene on dogs, rabbits, rats, sparrows, frogs, tritons, and newts. The dogs, rabbits, rats, and sparrows were placed in an atmosphere of acetylene, either pure or mixed with air; pure acetylene was also introduced into the lungs of dogs by means of a canula inserted in the trachea. Frogs, tritons, and newts were placed in the gas and in water saturated with acetylene.

The authors conclude that acetylene is highly toxic. The inhalation of 500 c.c. of the pure gas is fatal to dogs unless energetic artificial respiration is resorted to; air containing 20 per cent. of the gas is always fatal to dogs left in it for an hour. Acetylene present in air in small proportion gives rise, in animals, to a period of excitement followed by one of paralysis, during which cardiac and respiratory failure are observed; paralytic symptoms then supervene and death occurs without convulsions. W. J. P.

Cholesterol and Bile Salts as Chemical Vaccines for Snake Poison. By C. PHISALIX (*Compt. rend.*, 1897, **125**, 1053—1055).—The author confirms Fraser's statements as to the antitoxic effect of bile in relation to snake poison. Bile salts and cholesterol have the same effect on viper poison as the bile as a whole, but in both cases this property disappears on heating at 120° for 20 minutes. The bile salts and cholesterol have also a vaccinating, but not an antitoxic, effect. When injected subcutaneously, they confer immunity to snake poison, and this behaviour as a vaccine of a definite chemical compound like cholesterol is particularly noteworthy. C. H. B.

Chemistry of Vegetable Physiology and Agriculture.

Proteolytic Enzyme of Yeast Extract. By MARTIN HAHN (*Ber.*, 1898, **31**, 200—201).—The author has succeeded in demonstrating the presence in yeast extract, as obtained by Buchner's method (Abstr., 1897, i, 154, 380), of an enzyme which has the power of rendering albumin soluble. When a few c.c. of the yeast extract is mixed with a few drops of chloroform or any other antiseptic, and then added to solid phenol-gelatin contained in a test tube, an appreciable amount of the gelatin dissolves in the course of 24 hours, and at the end of several days the whole mass has turned liquid. These results are in agreement with those obtained by Schützenberger and by Salkowski on autodigestion, and by Will on proteolytic enzymes in pure yeast cultures (*Centr. Bakt.*, 1896, ii, 92). It is shown that different kinds of yeast yield solutions containing this proteolytic enzyme, and

Neumeister's statement (this vol., ii, 177) that he could obtain no such solution is considered inexplicable. Similar solutions can be obtained from tuberculosis and typhus bacilli. J. J. S.

Detection of the Proteolytic Enzyme of Yeast. By L. GERET and MARTIN HAHN (*Ber.*, 1898, 31, 202—205. Compare preceding abstract).—The yeast extract as obtained by Buchner's method is an opalescent liquid, and even after several filtrations through paper and Kieselguhr filters contains isolated yeast cells. If the solution, which has a somewhat acid reaction, is treated with chloroform and then digested at 37° in a thermostat, a copious precipitate of albumin is deposited in the course of a few hours; at the end of several days, this precipitate has materially diminished, although it has not entirely disappeared, and the liquid is again quite clear. At the end of 2—4 weeks, the amount of precipitate has again reached a maximum, but now consists chiefly of tyrosine crystals; an appreciable amount of leucine may also be obtained by evaporating the mother liquor. Phosphorus appears to be eliminated from the nucleo-albumin after 24 hours, and the small amount of sulphur which occurs in the yeast extract appears to be converted into sulphuric acid. Tables are given showing (1) the gradual disappearance of coagulated albumin, and (2) the gradual increase in the amount of nitrogen in the filtrate when the extract is heated at 37°. J. J. S.

Alcoholic Fermentation without Living Yeast Cells. By EDUARD BUCHNER and RUDOLF RAPP (*Ber.*, 1898, 31, 209—217. Compare Buchner, Abstr., 1897, ii, 154, 380; this vol., ii, 127).—In reply to Stavenagen (this vol., ii, 88 and 177), it is stated that the small numbers of bacteria and yeast cells were not sufficient to account for the large evolution of carbonic anhydride from cane-sugar and the yeast extract. Actual experiments with extract which had been kept for some time so that the zymase was all destroyed, but which still contained living cells, gave practically no carbonic anhydride during the first 40 hours. Stavenagen's criticism that the Berkfeld Kieselguhr filter would not retain yeast spores is considered immaterial, since spores do not occur in the yeast extract obtained from bottom yeast. In reply to von Manassein (this vol., ii, 177), it is stated that a number of her experiments were carried out under conditions which did not admit of complete sterilisation, and other experiments, namely, those in which dried yeast was heated to 300—308° or boiled for 45 minutes and was then shown to be capable of fermentation, must be incorrect, since zymase would be completely destroyed under such conditions. Further experiments with yeast extract have yielded even better results, winter apparently being especially favourable for the production of a strongly active extract.

Zymase differs from most enzymes, for example, invertase, and more closely resembles the substance discovered by Fischer and Lindner (Abstr., 1896, i, 195) in *Monilia Candida.* Zymase diffuses very slowly, if at all, through parchment paper; previous statements regarding its diffusibility are erroneous. Glycogen is readily hydrolysed and fermented by zymase, but not, according to Koch and Hosaeus (Abstr, 1895, ii, 322) by living yeast. This is probably due to the fact that the zymase is enclosed in the cells of yeast, and as glycogen cannot diffuse through the cell-wall, it thus does not come into contact with the enzyme.

Small quantities of potassium arsenite and carbonate appear to render the yeast extract somewhat more active.

Comparative experiments show that an extract which has been filtered through biscuit porcelain cannot ferment to nearly the same extent as the unfiltered extract. This agrees with experiments made by Sirotinin and by Martin, who have shown that peptone, pepsin, egg-albumin, serum-globulin, &c., are retained by Pasteur's porcelain filter or by a Chamberland's filter the pores of which have been filled with precipitated silica. Probably zymase is also incapable of passing through such filters to any appreciable extent. J. J. S.

Soluble Ferment present in Wine. By GIULIO TOLOMEI (*Real. Accad. Linc.*, 1896, [v], 5, i, 52—56).—Contact with air causes the oxidation of the colouring matter of wine, rendering it insoluble, and developing a characteristic odour; this, according to Martinand (*Compt. rend.*, 1895, 121, 502), is due to the presence of a soluble enzyme, resembling the laccase which Bertrand has isolated from many plants (Abstr., 1895, i, 386; 1896, ii, 61, 571; 1897, ii, 117, 338).

The author finds that the pulp of mature grapes gives, in the air, the characteristic reactions with guaiacum tincture, quinol, and pyrogallol which Bertrand has noted with laccase. After the pulp has been heated at 100°, these reactions are not obtained, and the juice no longer decolorises in the air; these properties are restored to the sterilised pulp by adding the enzyme precipitated by alcohol from a wine must which has not been heated. The soluble ferment dissolves but slowly from the pulp, the latter giving intense colour reactions, whilst the liquor in which it is suspended gives but little colour; successive washings continually extract the ferment from the pulp, and an energetic fermentation favours its solution more than a sluggish fermentation.

On adding a muscatel ferment to a sterilised wine must, the latter after a few days develops a crop of *Saccharomyces ellipsoideus* which, when separated, sterilised, and exposed to the air, gives on extraction with chloroform water, Bertrand's reactions for laccase; similar results were obtained with *Saccharomyces cerevisæ* and *S. apiculatus*.

A young beer yeast was suspended in an aqueous solution of dextrose, alcohol added, and the liquid kept at 0° for 3 days. The liquid was then filtered through a D'Arsonval bougie, and the filtrate, which contained no living organisms, was found (1) to yield hydrogen sulphide with sulphur, (2) to give carbonic anhydride in contact with air, and (3) to absorb oxygen from the air; it also gave the Bertrand colour reactions. All these properties were lost on heating at 72°, and the liquid, on adding alcohol, gave a white precipitate of the enzyme, which, when added to the liquor sterilised by heat, restored to it the properties lost during sterilisation.

The author finds, moreover, that the enzyme may play a part in the maturing of wine. On adding the enzyme extracted from muscatel yeast to an ordinary white wine and exposing it to the air, the wine acquires a muscatel bouquet which it did not previously possess; this action was hastened by slightly ozonising the air in contact with the wine, and contrasts with the action of organised ferments in that it is greatly promoted by sunlight.

It is concluded that a soluble ferment is elaborated during the development of *Saccharomyces ellipsoideus*, which, remaining dissolved in the wine, is capable of producing all the modifications which constitute the maturing of wine. W. J. P.

Changes in Fat during Germination. By MAX WALLERSTEIN (*Chem. Centr.*, 1897, i, 63; from *Forsch.-Ber. Lebensm. Bez. Hyg.*, **3**, 372—388).—The observations were made on barley during and after softening, and on green malt. The results of examining the ethereal extract are given in tabular form. The most marked change is an increase in free fatty acids and a fall in the amount of neutral fat as germination proceeds. The unsaponifiable constituents markedly increase. W. D. H.

Dependence of the Respiration of Plants on the Amount of Indigestible Proteids they contain. By WLADIMIR PALLADIN (*Bied. Centr.*, 1897, **26**, 753—754; from *Bot. Centr.*, 1896, **67**, 79).—Earlier experiments with leaves of *Vicia Faba* showed that the intensity of respiration increases with increase in amount of carbohydrates within certain limits, after which it is about in proportion to the proteids. Only the active proteid of the protoplasm is concerned, and in germinating seeds, in which its amount is comparatively small and varying, there is no definite relation to the respiration.

In the experiments now described, the total and the indigestible proteid nitrogen were determined by Stutzer's method in seedlings of *Triticum* and *Lupinus luteus* growing in darkness; the carbonic anhydride evolved was also determined, and in some cases the amount of soluble carbohydrates. With *Triticum*, the relation CO_2/N_2 was almost constant ($= 1{\cdot}1/1$) and exactly the same as with etiolated leaves of *Vicia Faba*. In the case of lupins, the germinating seeds of which contain but little soluble carbohydrates, the quotient is usually a good deal less, and, moreover, varies according to the degree of germination; the results show, however, that the intensity of respiration, in the case of lupins as with wheat, depends on the amount of indigestible proteid. Contrary to what is usually supposed, the intensity of respiration of wheat continues to increase after the intensity of growth begins to diminish.

During germination in darkness, there is not only a breaking up of proteids, but also a conversion of digestible into indigestible proteids. The author's results, with those of Frankfurt (Abstr., 1894, ii, 113), and of Prianischnikow (Abstr., 1896, ii, 380), show a difference in this respect between oily and starchy seeds, on the one hand, and the more nitrogenous seeds (leguminous) on the other; the former show a considerable increase in indigestible proteids when germinated in darkness, the latter a decrease followed by an inconsiderable increase.

N. H. J. M.

Insoluble Carbohydrates of Wheat. By H. C. SHERMAN (*J. Amer. Chem. Soc.*, 1897, **19**, 291—316).—On hydrolysing the carbohydrate matter yielded to boiling dilute acids by vegetable cells from which the starch has been removed, or hemicellulose from wheat bran, pentoses alone are produced. The product of hydrolysis was brown and of a loose, fibrous texture. On immersion in a solution of ferric chloride and potassium ferricyanide, it fixes a large proportion of ferrous ferricyanide as a deep blue dye, behaving in this respect like a lignocellulose, and when treated with chlorine, the fibrous substance is partially converted into lignone chloride, $C_{19}H_{18}Cl_4O_9$, a compound obtained by Cross and Bevan from chlorinated jute fibre (Trans., 1889, 205).

The cellulose prepared from the fibre by chlorination is apparently not of the normal type; it yields dextrose on hydrolysis, but none of the specific products of hydrolysis of the furfural-yielding group, and on treatment with caustic soda, a substance resembling wood-gum is obtained.

The furfural-yielding compounds constitute one-half of the seed coat exclusive of starch and proteids, and by far the greater part is in the form of easily hydrolysed pentosans.

From experiments on a steer fed with wheat bran only, it appears that the digestibility of the insoluble carbohydrates ranges from 25—100 per cent. The non-nitrogenous extract with a mean digestibility of 76 per cent. is composed of substances whose percentage digestibility varies from 100 to less than 40. Even in the case of the crude fibre, the digestibility of one of the constituents considerably exceeds that of the other. A. W. C.

Raffinose in American Sugar Beet. By WINTHROP E. STONE and W. H. BAIRD (*J. Amer. Chem. Soc.*, 1897, **19**, 116—124).—Oxidation with nitric acid fails to detect raffinose when applied to complex mixtures of salts and organic matter, such as molasses. By precipitating molasses from the "crystalliser" of the Norfolk Factory with lead acetate, and oxidising the separated sugars with nitric acid, mucic acid melting at 213° was obtained. This may be regarded as a fairly satisfactory qualitative proof of the presence of raffinose, but nothing short of actual separation of the sugar can be regarded as conclusive.

The authors attempted this isolation in many ways, and by using a method depending on precipitation with lead acetate and strontium oxide, and extraction of the sugars thus obtained with cold methylic alcohol, they obtained fractions having a rotatory power of over 100°, and from this infer that raffinose occurs in the juices of the American sugar beet in appreciable quantities.

Illustrations are given of the appearance of crystals of the various fractions under the microscope, which show that the influence of raffinose is manifested, not in the appearance of isolated raffinose crystals, but in a modified and abnormal appearance of all the crystals. This would seem to afford a ready means of identifying small amounts of raffinose when mixed with sucrose. A. W. C.

Glucosides contained in Digitalis Leaves. By C. C. KELLER (*Chem. Centr.*, 1897, i, 1211). See this vol. ii, 267.

Composition and Nutritive Value of some Edible American Fungi. By LAFAYETTE B. MENDEL (*Amer. J. Physiol.*, 1898, 1, 225—238).—After giving in full tables the composition (nitrogen and proteid, ether extract, alcohol extract, carbohydrates, crude fibre, ash) of a large number of edible American fungi, the conclusion is drawn that the popular idea of their great nutritive value is a fallacy. It is not unusual to multiply the total nitrogen by 6·25 and express the result as proteid, but even if this is done, and the 75 to 90 of water in fungi allowed for, the amount of proteid is only small. Digestion experiments show that the amount of nitrogenous material not available for nutrition is frequently equivalent to over half of the non-extractive nitrogen present. *Morchella esculenta* is a species of average composition; it contains 10·5 per cent. of solids and 0·48 per cent. of nitrogen; of this, about one-third is extractive nitrogen, and nearly half of the remainder is indigestible. But even if all the nitrogen were present as proteid, the vegetarian would have to consume several kilos. in order to obtain the requisite daily 100 grams of proteid. The fungi are, in fact, inferior in nitrogenous nutritive value to many other fresh vegetables, and although they have a relatively high carbohydrate content, such expressions as "vegetable beefsteak" applied to them are most inappropriate.

W. D. H.

Composition of Well Waters and Soils specially suitable for Tobacco Cultivation in the Charotar, Gujerat. By JOHN W. LEATHER (*Agricult. Ledger*, 1895, No. 14, Calcutta).—A number of well waters, used for irrigating tobacco crops, were analysed, and results obtained which accord with the respective values attached to them by the cultivators. The richest water, taken from a well at Durmuj, contained, N_2O_5, 1948; Na_2O, 6264; CaO, 92; MgO, 424; SO_3, 663; and Cl, 4997 per million. This sample contained no potash, but in others the amount of potash was considerable, one sample containing as much as 1098 per million. The value of the waters depends mainly on the amounts of nitrates they contain, and it is estimated that, in the case of very rich waters, an amount of nitrogen may be applied corresponding with 500 lbs. of potassium nitrate per acre.

The soils of which analyses are given are, as is generally the case with Indian soils, poor in nitrogen ($N = 0·025$ to $0·061$ per cent.). The percentage of potash ($K_2O = 0·26$ to $0·56$) is high as compared with English soils; and the amounts of phosphoric acid (with one exception) are much above the average ($P_2O_5 = 0·10$ to $0·42$ per cent.).

N. H. J. M.

Recent Experience in the Cultivation of Peaty Land. By BRUNO TACKE (*Bied. Centr.*, 1898, 27, 19—22; from *Mitteil. Ver. Förd. Moorkultur*, 1897, 109).—Experiments in which oats, wheat, and mustard were grown in peaty soil, with and without phosphatic manure, showed that, whilst phosphates increased the yield of oats by 100 per cent., when the soil contained 0·1 per cent. of phosphoric acid, the increase was only 2 per cent. when the soil contained 0·43 per cent. of phosphoric acid. Fleischer found that, with soil containing 0·78 per cent. of phosphoric acid, the addition of phosphates gave better results.

This divergence is probably due to the soil phosphates being in various forms of different value. In peaty soils, the phosphoric acid is in combination with iron, as ferrous ferric phosphate, which is almost equal to basic slag as a phosphatic manure, and as ferric phosphate, which is much inferior. The effect of manuring with phosphates would thus depend on the nature as well as on the amount of the phosphoric acid in the soil.

Superphosphate gave slightly better results than basic slag, but only on the soils poorest in phosphoric acid.

The different potash manures gave very similar results. Potash manures should be applied to peaty soils, partly or wholly in the spring, to avoid loss in drainage.

Experiments made to ascertain the effect of nitrate and of green manuring on the yield of produce are next described. Three soils were used, containing (1) 2·5, (2) 2·86, and (3) 3·39 per cent. of nitrogen, and 5—6 per cent. of lime. The relative amounts of produce without manure were (1) 100, (2) 276, and (3) 384. Sodium nitrate (60 kilos. per hectare) increased the yield as follows: (1) 75, (2) 41, and (3) 26 per cent. With green manuring, the increase was (1) 104, (2) 56, and (3) 26 per cent. The results depend largely on the physical nature of the soil, and the great effect of green manuring (on soil No. 1) is supposed to be due to the porosity of the soil being increased. In cultivating peaty land, the porosity should be increased as much as possible by the growth of deep-rooted plants and by mechanical treatment. Nitrification would thus become more active, and nitrogenous manuring less necessary. N. H. J. M.

German East African Soils. By FERDINAND WOHLTMANN (*Bied. Centr.*, 1898, **27**, 13—14; from *Mitteil. Versuchsfelde landw. Akad. Bonn-Poppelsdorf*, No. 10. Compare Abstr., 1897, ii, 463).—Whilst the soils of Cameroon are very rich, those of German East Africa are less uniformly good, many of them being deficient, especially in phosphoric acid and potash, and some quite unsuited for remunerative cultivation. In some parts, however, the soil is quite equal to that of Cameroon. The presence of luxuriant natural forests is not always an indication of a good soil, and the nature of the vegetation must be ascertained in order to be able to judge as to the value of the land.

N. H. J. M.

Importance of Chemical Analysis of Soils for the Laying out of Plantations. The Soils of Cameroon. By FERDINAND WOHLTMANN (*Bied. Centr.*, 1898, **27**, 8—9; from *Mitteil. Versuchsfelde landw. Akad. Bonn-Poppelsdorf*, No. 9. Compare Abstr., 1897, ii, 463).—The object of analysing the soils is to ascertain whether injurious substances are present, and the amount of nutritive matter only. The fine soil which passes through a 2 mm. sieve should be examined, and the determinations should include loss on ignition, nitrogen, and the mineral constituents soluble in hydrochloric acid (*loc. cit.*), the potash, soluble in hot hydrochloric acid, being also determined.

The tropical soils are divided into (1) very rich, (2) good, and (3) poor, according to the amounts of the different constituents they contain. N (1) 0·2, (2) 0·1, (3) 0·05; CaO and MgO, (1) 1·0, (2) 0·4, (3) 0·2; P_2O_5, (1) 0·2, (2) 0·1, (3) 0·06; K_2O (cold extraction) (1) 0·2,

(2) 0·1, (3) 0·05 per cent. The nature of the climate, the amounts of humus, alumina, and ferric oxide and the silica are important, and the geological conditions must be considered. N. H. J. M.

Injurious Effect of Sodium Nitrate. By PAUL WAGNER (*Bied. Centr.*, 1897, **26**, 797—800; from *Landw. Presse*, Nos. 18 and 19).—The results of experiments made at Darmstadt showed that perchlorate occurs, as an impurity, in sodium nitrate to the extent of 0·14 to 1·65 per cent. The large amounts, 3 and even 7 per cent., found by Sjollema are probably quite exceptional.

Whilst Sjollema concluded that an application of 200 kilograms per hectare of sodium nitrate containing 0·5 per cent. of perchlorate would be injurious, the author has ascertained that, in ordinary practice, sodium nitrate containing as much as 1·65 per cent. of perchlorate has been found to be without injurious effect.

With regard to the effect of sodium nitrate itself on vegetation, a number of experiments were made in which oats were grown in pots and manured with amounts of nitrate corresponding with 20 to 120 cwts. per hectare. The greatest yield of straw was obtained with 80 cwts. of nitrate per hectare, the yield being very slightly less with 100 and with 120 cwts.; the greatest yield of grain was obtained with the greatest application of nitrate (120 cwts.). The results show that, under the conditions of the experiments, oats will bear a very heavy dressing of sodium nitrate. The nitrate should be applied as uniformly as possible, and only after being finely ground. N. H. J. M.

Analytical Chemistry.

Apparatus for Gas Analysis. VIII. By OTTO BLEIER (*Ber.*, 1898, **31**, 236—239).—It is pointed out that in the form previously described (this vol., ii, 137) the connecting tubes between the bulbs must not be more than 2·5 mm. in diameter, otherwise the readings will not be sufficiently accurate. The capacities of the several bulbs should be respectively 20, 16, 12·8, 10·24, 8·19, 6·55, &c., per cent. of the total capacity supposing the lowest bulb to have a capacity of 20 per cent. of the whole; as it is technically almost impossible to obtain exactly these relative volumes, the bulbs should be made as nearly as possible these sizes and then carefully calibrated.

A measuring apparatus is described by the aid of which gas volumes can be accurately measured within relatively wide limits. The gas is measured in the two-armed pipette *AB*, which is connected by a differential manometer with a compensator. Each of the five lower bulbs of *A* has a capacity of 10 per cent. of the total volume *A* + *B*, and each

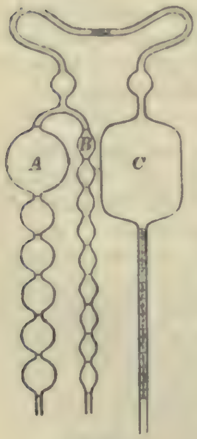


Fig. 1.

of the nine bulbs of B a capacity of 1 per cent. The space between the upper marks in A and B (that is, the upper bulb and the capillary) has a capacity of 41 per cent. of the total volume. The upper part of C has a capacity of 100 volumes, and the graduated tube a capacity of 2·5 volumes. This apparatus is used in pretty much the same manner as that previously described.

As the two-armed measuring tubes with reserve chamber, previously described, cannot always be used for very correct reading, the author has constructed a three-limbed apparatus (see Fig. 2). Each bulb in the limb B must have a smaller capacity than C, and each bulb of A a smaller capacity than $B + C$. The three limbs, A, B, and C, together have a capacity $= 98·48$ c.c., and the capacity of the space between the top marks and the tap $= 1·52$ c.c., giving a total $= 100$ c.c. J. J. S.

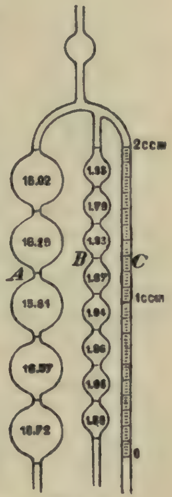


Fig. 2.

Alkalimetry, Acidimetry, and Iodometry, by means of Crystallised Iodic Acid. By E. Riegler (*Chem. Centr.*, 1897, 1, 1169—1170; from *Bul. soc. Sciinte*, 6, 37—44).—Pure iodic acid for analytical purposes may be obtained from Merck. Although it may be used with the ordinary indicators, the author prefers adding it in excess and then titrating the uncombined portion with solution of sodium thiosulphate, using starch as indicator. The reaction is represented by the equation $6Na_2S_2O_3 + 6HIO_3 = 3Na_2S_4O_6 + 5NaIO_3 + NaI + 3H_2O$. [Compare, however, Walker (this vol., ii, 139).] L. de K.

Basic Lead Nitrate as a Clarifying Agent for Polariscopic Purposes. By Franz Herles (*Chem. Centr.*, 1897, i, 332—333; from *Zeit. Zuck.-Ind. Böhm*, 21, 189—193).—When using basic lead nitrate, instead of the basic acetate, it is necessary to substitute 143·5 for 144 in the well-known Clerget's formula. For the estimation of saccharose in the presence of raffinose by polarisation before and after inversion, the following formulæ are proposed, $S = \frac{(0·4724 + 0·002t)\ P - I}{0·9074 - 0·003t}$, and $R = \frac{P - S}{1·85}$, in which S stands for saccharose, R for raffinose, P for the polarisation before, and I for that after inversion, whilst t represents the temperature after inversion. L. de K.

Estimation of Chlorine, Bromine, and Iodine in Saline Waters. By Percy A. E. Richards (*Chem. News*, 1897, 76, 293).—In waters where the chlorine is greatly in excess of the bromine and iodine, the total halogens are estimated with decinormal silver nitrate. The iodine is estimated by treating 250 to 500 c.c. with acetic acid and hydrogen peroxide for half an hour, extracting with chloroform, and after the removal of the hydrogen peroxide by washing with water, titrating with decinormal sodium thiosulphate. The bromine is estimated by shaking the solution from which the iodine has been removed with sufficient chlorine water, extracting with chloroform, washing any chlorine from the extract with water, adding a few crystals of potassium iodide, and titrating with sodium thiosulphate. D. A. L.

Decomposition of Iodine Compounds by Paraldehyde. By Wachhausen (*Chem. Centr.*, 1897, i, 493; from *Pharm. Zeit.*, **42**, 95—96).—By the action of paraldehyde on the iodides of sodium, potassium, and iron, the whole of the iodine is liberated. In making use of this reaction as a test for iodine, a little starch paste is added to the solution to be tested and then a few drops of paraldehyde; if iodine is present, the zone of contact of the two solutions becomes red or blue, according to the concentration. Or the solution to be tested may be shaken with paraldehyde, a little starch paste added, and the liberated iodine dissolved in carbon bisulphide. If the solution does not contain more than 1 part of iodine in 500,000 parts, the carbon bisulphide should be repeatedly shaken with fresh quantities of the solution to which the paraldehyde has been added. E. W. W.

Estimation of Sulphuric Acid. By Felix Marboutin (*Chem. News*, 1897, **76**, 232—234).—A critical *résumé* is given of the methods more frequently employed for the volumetric estimation of sulphuric acid, and then the following method is set forth as having particular advantages in water analysis, but is not applicable unless organic matter is absent or has been removed. One hundred c.c. of the water is acidified with hydrochloric acid, boiled to drive off carbonic anhydride, cooled to just below boiling, and treated, drop by drop, with 30 c.c. of a solution of barium chloride containing 4·8 grams of the crystallised salt per litre. After remaining 12 hours at 40°, the solution is neutralised with a few drops of ammonia, treated with 30 c.c. of a solution of potassium chromate (containing 3·9 grams of the crystalline salt per litre), gently heated, then cooled, and made up to 300 c.c. One hundred c.c. of the clear liquid is now treated with 2 c.c. of N/4 sulphuric acid and 5 c.c. of a solution of arsenious acid (prepared by dissolving 4·95 grams of arsenious acid by gently heating with water containing 10 grams of potash, cooling, neutralising with sulphuric acid, and making up to a litre). The mixture is warmed gently, and shaken until completely decolorised, the solution neutralised with potassium carbonate and titrated with a solution of iodine, using starch as an indicator, a corresponding titration is made with a 100 c.c. of distilled water, free from sulphuric acid, and from the difference between the two titrations the amount of sulphuric acid in the sample is calculated. The iodine solution is prepared by dissolving 2·54 grams of resublimed iodine in a solution containing 5 grams of potassium iodide, making up to a litre, and standardising with a known weight of sodium thiosulphate. D. A. L.

Colour Reactions of Nitric and Chloric Acids. By E. C. Woodruff (*J. Amer. Chem. Soc.*, 1897, **19**, 156—170).—The author has endeavoured to find new tests for nitric and chloric acids which would differentiate between the two, both in mixtures and when other compounds are absent. The latter object has been attained several times, and nitric acid may be detected in presence of chloric acid in the following manner. A solution of 2 grams of dimethylaniline in 100 c.c. of concentrated sulphuric acid becomes a very strong blood-red when nitric acid alone is added, and brown with chloric acid alone, whilst a mixture of nitric and chloric acids produces only the strong blood-red colour noticed with nitric acid alone.

Details of some hundreds of colour reactions of these two acids with other organic substances are given. A. W. C.

A Volumetric and Gasometric Method of Estimating Hydroxylamine and Hydrazine. By KARL A. HOFMANN and F. KÜSPERT (*Ber.*, 1898, 31, 64—67. Compare Abstr., 1897, ii, 554, 557).—The authors estimate hydroxylamine and hydrazine by oxidation with a dilute solution of vanadic sulphate; the liberated nitrogen is collected and measured, and the vanadylic sulphate produced in the change titrated with potassium permanganate. The solution of vanadic salt is prepared by dissolving ammonium metavanadate in concentrated sulphuric acid and diluting the liquid with water. M. O. F.

Estimation of Phosphorus in Phosphorised Oils. By ANTON SEYDA (*Chem. Centr.*, 1897, i, 560; from *Zeit. öffentl. Chem.*, 3, 13—15).—The author has found that the phosphorus cannot be fully oxidised in the wet way, but that a fusion must be resorted to. To estimate the phosphorus in its solution in olive oil, 30 drops of the sample is put into a 300 c.c. Kjeldahl flask, and 20 c.c. of fuming nitric acid is very slowly added; when the first violent action is over, the flask is heated for 1 hour on the water bath, the bulk of the acid expelled by boiling, the whole diluted with boiling water, and then evaporated to dryness in a platinum dish. Three grams of sodium carbonate and 1 gram of potassium nitrate dissolved in water are then added, and the whole again evaporated to dryness and charred, more nitre being gradually added until a white ash is obtained. The ash contains all the phosphorus as phosphoric acid, which can be estimated by the molybdate process. L. DE K.

Estimation of Phosphoric Acid in Sweet Wines. By WILHELM THÖRNER and R. USTER (*Chem. Centr.*, 1897, i, 825—826; from *Forsch. Ber. Lebensm.*, 4, 55—58).—After criticising the conventional process, and also the method proposed by Glaser and Mühle, the authors recommend the following. Twenty-five c.c. of the sample (if poor in sugar more may be taken and evaporated to 25 c.c.) is heated in a covered beaker with 10 c.c. of strong nitric acid on the water bath for half an hour. Ammonia is added in very slight excess, and then 25 c.c. of ammonium citrate solution; although the liquid becomes much darker, it remains clear. The phosphoric acid is then precipitated by adding 15—20 c.c. of magnesia mixture with constant stirring. L. DE K.

Estimation of Citrate-Soluble Phosphoric Acid. By OTTO REITMAIR (*Chem. Centr.*, 1897, i, 487; from *Chem. Rundsch.*, 1897, 42—43).—The author has found that when 50 c.c. of the conventional solution is poured into a beaker containing 10 c.c. of 10 per cent. sulphuric acid, before adding the conventional magnesium citrate mixture the precipitate is more crystalline and better fitted for filtering through a Gooch crucible. L. DE K.

Simultaneous Estimation of Carbon and Nitrogen by Combustion in a Vacuum. By KARL A. H. MÖRNER (*Zeit. anal. Chem.*, 1898, 37, 1—21).—The method of combustion first introduced by Frankland and Armstrong (this Journal, 1868, 87—101) and subsequently very fully described in Sutton's *Volumetric Analysis*, is especially suitable for the analysis of organic substances of which only small quantities are available. The author has introduced but few modifications, the most important being the mixing of the substance with moist cupric oxide, and the expulsion of the water by heating the combustion tube in a water bath during the exhaustion before combustion. By this means, the residual air is so completely expelled that in the analysis of a non-nitrogenous substance only a few hundredths of a cubic centimetre of nitrogen are obtained. The substance is mixed with the cupric oxide in a mortar, and mixing must be very intimate. As the use of a copper spiral rarely effects the complete reduction of the nitric oxide, which must therefore always be sought for and measured, there is no advantage in inserting one. Combustible gases (CO, H_2, C_2H_6, C_2H_4, and C_2N_2), varying in quantity and composition according to the substance burnt and the rate of heating, are almost invariably present, and must be exploded with oxy-hydrogen gas and estimated by the usual methods of gas analysis. Although substances containing 27 per cent. of sulphur were analysed by this method, no error was introduced by its presence and no sulphurous anhydride was ever found in the gases. The errors in a series of analyses ranged from $+2{\cdot}5$ to $-1{\cdot}1$ per cent. of the carbon present, and $+2{\cdot}3$ to $1{\cdot}4$ per cent. of the nitrogen, but the mean error was only 0·7—0·8 per cent. M. J. S.

Combustion of Organic Substances by Wet Methods. By ISAAC K. PHELPS (*Zeit. anorg. Chem.*, 1898, 16, 85—98).—The method is based on the iodometric estimation of carbonic acid previously described by the author (Abstr., 1896, ii, 673). Oxalic, formic, and tartaric acids and other easily oxidisable compounds are oxidised by potassium permanganate and the carbonic anhydride is absorbed in barium hydroxide solution, the excess of barium hydroxide being determined as previously described. Compounds which are difficult to oxidise and compounds like the carbohydrates which, when oxidised with chromic and sulphuric acids, yield a mixture of carbonic anhydride and carbonic oxide, are oxidised with a mixture of potassium dichromate and sulphuric acid in a closed flask so that any carbonic oxide which is formed is converted into carbonic anhydride by the prolonged action of the oxidising agent. The substance, enclosed in a sealed tube of thin glass, is brought into the oxidising flask, which, by means of a glass tube fitted with a tap, is connected with the flask containing the barium hydroxide. The air is expelled by boiling both the water in the oxidising flask and the hydroxide solution in the other flask; the flasks are then closed from the air and from each other, and the mixture of potassium dichromate and sulphuric acid is admitted to the oxidising flask through a separating funnel. The oxidation is effected by heating at 105°, and the carbonic anhydride is then driven over into the barium hydroxide by boiling the solution.

The oxygen in many organic compounds can be determined by using a weighed quantity of potassium dichromate in the above method, and after the oxidation is complete determining the excess of the oxidising mixture employed by treating the residue with hydrochloric acid, absorbing the chlorine evolved in a standard solution of alkali arsenite, and titrating the excess of arsenite with iodine solution.

This method is not applicable to substances which are both difficult to oxidise and very volatile. E. C. R.

Detection of Sodium Hydrogen Carbonate in Milk. By Léon Padé (*Chem. Centr.*, 1897, i, 337; from *Ann. chim. anal. appl.*, 1886, 1, 328).—The soluble portion of the ash obtained from 10 grams of milk only requires one drop of N/10 sulphuric acid for neutralisation, but if the sample contains sodium hydrogen carbonate, much more acid will be required. In this case, it must be remembered that part of the added soda may have been converted into phosphate. An estimation of the soluble phosphoric acid should, therefore, not be omitted, and this must be calculated into the corresponding amount of sodium hydrogen carbonate. L. de K.

Estimation of Zinc in Foods. By Janke (*Chem. Centr.*, 1897, i, 519; from *Zeit. Nahrungsm. Hyg. Waar.*, xi, 25—26).—To 50 to 100 grams of the sample which has been cut up into small pieces, dried for 3 hours at 125°, and then powdered, 25 c.c. of nitric and 10 c.c. of sulphuric acid are added; after the first violent action is over, the acid is evaporated and the residue incinerated to a white ash. This is dissolved in nitric acid, the excess of acid removed by evaporation on the water bath, the residue dissolved in water, filtered, and the filtrate neutralised with sodium carbonate; any iron present is precipitated as phosphate by means of sodium acetate, and the zinc is then precipitated as sulphide by hydrogen sulphide. L. de K.

Electrolytic Separation of Cadmium and Zinc, Zinc and Cobalt, and Antimony and Tin. By A. Waller (*Zeit. Elektrochem.*, 1897, 4, 241—247).—*Zinc and Cadmium.*—A neutral solution of the chlorides in 120 c.c. of water is treated with 8 grams of potassium oxalate and 2 grams of ammonium oxalate and electrolysed at 80—85°. Since the E. M. F. required for the decomposition of the zinc salt is about 0·3 volt higher than that required for the cadmium salt, and the resistance of the electrolytic cell employed was 10 ohms, it follows that a current not exceeding 0·03 ampère will deposit the cadmium and not the zinc. With 0·02 ampère, the deposit of cadmium was smooth and free from zinc. The test analyses given show that the method yields excellent results.

Zinc and cobalt were separated by the method described by Vortmann (*Elektrochem. Zeit.*, 1, 6). Cobalt potassium sulphate and zinc ammonium sulphate were dissolved in water, 6 grams of Rochelle salt, 1 to 1·5 grams of potassium iodide, and 2 to 3 grams of caustic soda added, and the whole made up to 150 c.c. and electrolysed at 60—65° with about 2 volts and 0·05 to 0·1 ampère. A little cobaltic oxide

Co_2O_3, is deposited on the anode which must be weighed after drying at 110°. The error of the determinations does not exceed 1 per cent. of the cobalt present.

Antimony and tin are separated by Ost's method. The antimony and tin salts are dissolved in 120 c.c. of a solution containing pure sodium sulphide (quantity not stated) and 2—3 grams of sodium hydroxide, and electrolysed at 60°. From the author's experiments, it follows that, under these circumstances, antimony free from tin is deposited when the E. M. F. employed varies between 0·45 and 0·7 volt. When the E. M. F. exceeds 0·7 volt, tin is deposited along with the antimony.

T. E.

Estimation of Copper in the Presence of Other Elements. By HARRY BREARLEY (*Chem. News*, 1897, **76**, 291—293, 303—304).—The author has applied his modifications of the cyanide titration of copper (this vol., ii, 140) in the presence of various elements, using in each case 0·10 gram of copper; alkali salts, equivalent to 20 c.c. of hydrochloric acid (twice normal strength) as chloride; excess of sodium carbonate, 30 c.c. (2N); excess of ammonia, 10 c.c. (2N). Sodium, potassium, magnesium, molybdenum, arsenic, antimony, bismuth, lead, and uranium cause no appreciable error. Zinc causes various difficulties, requires more ammonia, also more cyanide, and then reacts with the silver nitrate, so that it is best to add an excess of that reagent, filter, and titrate the excess with cyanide; or sodium pyrophosphate in concentrated solution may be added to both the solution and the standard copper, when fairly good results are obtained; the same reagent may be used in the presence of cadmium, although it is scarcely required in that case, but it is said to be useful in the presence of iron. With aluminium, the precipitates with ammonia or sodium carbonate are objectionable, and must be stopped by making alkaline with soda or potash, or by the use of sodium pyrophosphate, or a system of fractional filtration must be adopted, adding the bulk of the silver nitrate required before the filtration. The use of soda or potash is only to be recommended within narrow limits, not more than 10 c.c. of 2 normal soda in about 250 c.c. of solution. Neither citric nor tartaric acid can be used. With iron, the ammonia, the results are good, those with soda, bad. Manganese, in the ordinary way, forms a double salt with copper, and so gives low results; this can be obviated by adding sodium carbonate to the acid solution of copper and manganese until a slight precipitate forms, dissolving in a slight excess of acid, adding cyanide and then the usual excess of sodium carbonate; the approximate amount of copper must be known, as there are no distinctive colour changes, the last precipitate must not be filtered until it has changed from the white, crystalline to a brownish, granular, powdery, and more compact condition. Chromium as chromic oxide is harmful, as chromic acid it is harmless. Cobalt, nickel, silver, gold, palladium, and platinum have not been tried. Mercury exerts an influence that is fairly regular, as might be expected from Denigès' experience (Abstr., 1897, ii, 433). The precipitation of copper by means of sulphurous acid and potassium thiocyanate is satisfactory, but filtration is a difficulty; the author's recommendation, therefore, is to deçant the solution on to a small asbestos or paper pulp filter, wash, if necessary, with a dilute solution of the reagents; return to the precipitating vessel, add a few c.c. of nitric acid and 20 c.c. (2N) hydrochloric acid, boil for a few minutes, cool, neutralise with sodium carbonate, add the usual excess, and titrate. D. A. L.

Estimation of Copper as Iodide. By WILLENZ (*Chem. News*, 1897, **76**, 243—244).—The author employs an approximately N/25 solution of sodium thiosulphate which is standardised with metallic copper and verified before each set of analyses; the method used for this purpose must be rigorously followed in the actual analyses, and is as follows. Ten grams of electrotype copper is dissolved in equal volumes of water and nitric acid, sp. gr. = 1·4, the nitrous fumes are expelled by boiling, and the solution diluted to a litre. Ten c.c. of this solution is transferred to a 200 c.c. conical flask with a mark at 50 c.c., and carefully treated with dilute ammonia until precipitation ceases; dilute acetic acid is then gradually added to dissolve the precipitate, and this solution is made strongly acid with 5 or 6 c.c. of concentrated acetic acid, diluted to 50 c.c., and mixed with 10 c.c. of a 10 per cent. solution of potassium iodide, which is allowed to react exactly 2 minutes. The thiosulphate solution is now run in until a clear, yellowish-brown tint is attained; a small quantity of starch solution is next added, and the addition of thiosulphate continued with agitation until the colour changes to dirty greyish-violet, when the thiosulphate is added in drops, agitating vigorously after each drop; the appearance of a straw colour is taken as the end of the titration.

It is also applicable to pyrites, the preliminary treatment of the mineral being as follows. Ten grams of finely powdered and dry pyrites, with 8 c.c. of water and 2 c.c. of sulphuric acid, is treated gradually with from 25 to 30 c.c. of nitric acid, sp. gr. = 1·4, until there is no further effervescence, when another 3 c.c. of sulphuric acid is added. The whole is boiled, agitating meanwhile until pasty, treated with hot water, boiled again for a short time, cooled, diluted to half a litre, and filtered. One hundred c.c. of the filtrate is treated with a few c.c. of sulphuric acid, and while boiling, a warm, concentrated solution of sodium thiosulphate is gradually added; the solution assumes various colours, ultimately becoming black, but the boiling is continued until the precipitate agglomerates. The precipitate is washed rapidly several times with boiling water, by decantation and on the filter, until free from sulphuric acid, pressed between blotting paper, and gently heated in a crucible to get rid of moisture; finally, heated strongly to eliminate any sulphur, arsenic, antimony, and tin. The residue is dissolved in 1 c.c. of a mixture of equal volumes of water and nitric acid, sp. gr. = 1·4, and the process continued in the manner described above. D. A. L.

Separation of Mercuric from Bismuth Salts. By LUDWIG VANINO and F. TREUBERT (*Ber.*, 1898, **31**, 129—130. Compare Abstr., 1897, ii, 604).—Mercury and bismuth can be readily and accurately estimated in mixtures of the two by adding a mixture of hypophosphorous acid and hydrogen peroxide to the solution slightly acidified with hydrochloric acid, when the mercury is precipitated as calomel.

The filtrate is then made faintly alkaline with caustic soda, warmed to remove the hydrogen peroxide, and treated with more hypophosphorous acid, which precipitates the bismuth in the metallic state. A. H.

Estimation of Nickel in Iron, Cast Iron, and Steel. By PERILLON (*Chem. Centr.*, 1897, i, 437; from *Rev. chim. anal. appl.*, 5. 21—22).—A quantity varying from 0·25 to 4 grams of the sample is dissolved in nitric acid of sp. gr. = 1·2, and after the excess of acid has been expelled by boiling, enough aqueous potash is added to precipitate the metals; 25 grams of oxalic acid is then added, and the whole dried at 80°. On boiling the dried mass with 100 c.c. of a mixture of equal volumes of water, acetic acid, and alcohol for some time, and finally keeping for 4 hours at 80°, the nickel oxalate is completely precipitated and may be obtained free from alkalis by washing it with a 10 per cent. solution of oxalic acid. On ignition, it leaves nickel oxide, which may be freed from traces of iron and manganese by dissolving it in hydrochloric acid, and then adding bromine water and ammonia; the precipitate containing the iron and manganese is weighed and the necessary correction made. L. DE K.

Estimation of Chromium in Iron Chromium Alloys. By HEINRICH FRESENIUS and H. BAYERLEIN (*Zeit. anal. Chem.*, 1898, **37**, 31—35).—The greater part of the alloy employed was soluble in hydrochloric acid. The solution was evaporated to remove silica; the small portion not soluble was fused in a silver crucible with sodium peroxide, by which means all the chromium it contained was rendered soluble as chromate, and was united with the principal solution, which was then treated with an excess of sodium peroxide and digested at a gentle heat until evolution of gas ceased. The precipitated ferric oxide was redissolved and once more treated with sodium peroxide, and was then perfectly free from chromium. The main alkaline solution was next acidified with hydrochloric acid, treated with hydrogen peroxide, boiled until the peroxide was decomposed and the chromate reduced, and evaporated to dryness to get rid of silica dissolved from the glass vessels. After redissolving in acid, it was precipitated with ammonia in a platinum dish, and the precipitate of chromic oxide weighed. To remove traces of alumina, it was fused with alkali carbonate and nitrate, and the solution precipitated by ammonia and ammonium carbonate. The precipitate was not free from chromium, and required a repetition of the fusion, &c.

For the qualitative detection of iron, aluminium, and chromium, it is sufficient to free the solution from excess of acid, add excess of sodium peroxide, and heat; filter from the iron precipitate and test for alumina by ammonia after acidifying with hydrochloric acid.

M. J. S.

Thorium Hydrogen Oxalate. By CHARLES GLASER (*Zeit. anal. Chem.*, 1898, **37**, 25—28).—A further examination of the salt precipitated by hydrochloric acid from a solution of thorium oxalate in ammonium oxalate shows that it has not the simple composition previously assigned to it (Abstr., 1897, ii, 349), but is a mixture of the normal and the acid oxalate, the composition varying somewhat according to the circumstances under which it is precipitated. The analyses made are not quite conclusive, but when the amount of the normal salt ($ThC_2O_4 + 2H_2O$) calculated from them was deducted, the remainder indicated for the acid salt the formula $Th_2H_2(C_2O_4)_5 + 9H_2O$, after drying at 115°. M. J. S.

Volumetric Estimation of Antimony. By FERDINAND GAUTIER (*Actes Soc. Sci. Chili*, 1897, 7, 74—76).—See this vol., ii, 232.

Estimation of Carbonic Anhydride in Natural Waters. By CLARENCE A. SEYLER (*Analyst*, **22**, 312—316).—The author has made use of Trillich's process for the last seven years and again recommends it as being quite trustworthy. One hundred c.c. of the sample is mixed with a few drops of a neutral alcoholic solution of phenolphthalein and titrated in a narrow glass cylinder with a N/20 solution of sodium carbonate, until a faint, but permanent, red tint appears. This gives the free carbonic anhydride alone. The combined acid is then estimated by adding a little methyl-orange and titrating with N/20 hydrochloric acid; the total carbonic acid is the sum of the two titrations. Water, which, after boiling, turns red with phenolphthalein does not necessarily contain alkali carbonates, as the red coloration may be due to incompletely precipitated calcium or magnesium carbonate.

Attention is called to the great importance of the free and half-bound carbonic acid when Clark's softening process is to be applied. L. DE K.

Estimation of Paraffin in Petroleum of High Boiling Point. By D. HOLDE (*Chem. Centr.*, 1897, i, 309, 443; from *Chem. Rev. Fett ü. Harz. Ind.*, 4, 4—6, 21—25).—The author considers the processes of Pawlewski and Filemonowicz, Zaloziecki and Höland, Höland and Aisinmann as untrustworthy, and recommends the following: 10—20 c.c. of a sample solidifying at −5°, or 5 c.c. of a sample solidifying at 0°, is dissolved in the smallest amount of a mixture of equal parts of commercial absolute alcohol and ether. This solution, contained in a 200 c.c. Erlenmeyer flask, is cooled to −18° or −20° by a mixture of ice and salt, and more alcohol-ether mixture is cautiously added until no more oil-drops are visible and there is merely a flocculent deposit of paraffin. The liquid is then filtered, the funnel being surrounded with a freezing mixture, and washed with the ether mixture cooled to −20° if dealing with hard paraffin, but for soft paraffin a mixture of 2 vols. of alcohol and 1 vol. of ether cooled to −20° is used. The washing is continued until 10 c.c of the filtrate no longer gives an oily residue. The insoluble residue is dissolved off the filter by hot benzene, which is then evaporated in a tared beaker. When dealing with a product rich in soft paraffin, it is necessary to treat the residue once more in the manner described above.

Petroleum containing pitch or asphalt cannot be tested by this method. L. DE K.

Estimation of Paraffin in Crude Oil Distillates. By SEMJON AISINMANN (*Chem. Centr.*, 1897, 1, 1261—1262; from *Chem. Rev. Fett ü. Harz. Ind.*, 4, 106—108, 117—119).—The author states that paraffin is quite insoluble in absolute alcohol cooled down to −15° by means of a mixture of ice and salt. Five grams of the sample dissolved in a sufficiency of absolute alcohol is cooled to – 15°; when no more paraffin separates, the liquid is filtered off through a funnel surrounded by a freezing mixture, and the filter is washed with absolute alcohol at – 15° until the washings no longer become turbid on adding water. The paraffin is then dried in a desiccator and weighed. L. DE K.

Tabarie's Method for the Estimation of Alcohol. By NORMAN LEONARD and HARRY M. SMITH (*Analyst*, **22**, 225—227).—In this process, the sp. gr. of the alcoholic liquid is taken; a known volume is then evaporated to a small bulk to drive off the alcohol, and after making up to the original bulk with water, the sp. gr. is again taken. To get the sp. gr. of the spirit, either the extract gravity is divided into the present gravity, or the excess of extract gravity over 1000 is deducted from the present gravity. There having been much discussion as to which of the two calculations is the correct one, the authors have made a long series of experiments on the subject, and have come to the conclusion that, for spirits with but little solid matter, the division formula should be used, whilst the subtraction formula should be employed for heavily sweetened articles. L. DE K.

Behaviour of Glycerol towards Metallic Oxides with a view to its Quantitative Estimation. By FRIEDRICH BULLNHEIMER (*Chem. Centr.*, 1897, **1**, 522—523; from *Forsch. Ber. Lebensm.*, **4**, 12—21).—This is an account of a series of experiments, not yet finished, on the solubility of metallic oxides in glycerol containing excess of free alkali. The only oxides which dissolve to a considerable extent are those of copper, bismuth, and antimony. The following six oxides are completely reduced to the metallic state under the conditions of experiment, namely, silver, gold, mercury, rhodium, palladium, and platinum. L. DE K.

Detection of Glycerol. By GEORGES DENIGÈS (*Chem. Centr.*, 1897, **1**, 1002—1003; from *Bull. Soc. Pharm. Bordeaux*, **36**, 356).—The glycerol is first isolated by the well-known method of extraction with alcohol-ether, and after evaporating the latter, the residue is heated in a small retort with potassium hydrogen sulphate. If a pungent odour of acraldehyde is emitted, a rod moistened with Nessler's reagent, or an ammoniacal silver nitrate solution is exposed to the fumes; when acraldehyde is present, the reagent will become brown. L. DE K.

Detection of Picric Acid, and Distinction from Dinitrocresol (Saffron Substitute). By A. RYMSZA (*Zeit. anal. Chem.*, 1897, **36**, 813—814; from *Inaug. Dissert. Dorpat*).—The substance is macerated for several hours with water acidified with sulphuric acid, then mixed with 3 vols. of 95 per cent. alcohol, and digested for 24 hours at 50—60°. After filtration and evaporation of the alcohol, any fat is removed by shaking with light petroleum, and the liquid is then acidified with hydrochloric acid, and shaken repeatedly with ether. Urine, which in cases of poisoning with picric acid is always coloured reddish-brown by the presence of picramic acid, may be extracted with ether after simply acidifying. The residue obtained by evaporating the ether is then tested for picric acid, by (1) the isopurpuric acid reaction (blood-red colour on warming with potassium cyanide and soda),

(2) the picramic acid reaction (blood-red colour on heating with soda and grape-sugar), or, better, (3) soda and ammonium sulphide, (4) ammoniacal copper solution (yellowish-green precipitate of hexagonal needles which polarise light), and (5) by dyeing white wool. The limit of sensitiveness of the five reactions is 1 : 5000, 1 : 7000, 1 : 12500, 1 : 80000, 1 : 110000 respectively. Reactions (2) and (5) are less sensitive in presence of fats and other substances.

When reduced with stannous chloride and hydrochloric acid, potassium dinitrocresol gives a cherry-red colour with ammonia; picric acid, a brownish-red. Reduced with zinc and hydrochloric acid, the former gives a bright red colour, which disappears after a time. Picric acid sometimes gives a blue colour, later a brownish-green, which remains unchanged for days. M. J. S.

Detection of Cholesterol and Phytosterol in Fats. By ARTHUR FORSTER and RUDOLF RIECHELMANN (*Chem. Centr.*, 1897, i, 563; from *Zeit. öffentl. Chem.*, 3, 10—12).—The sample (50 grams) is boiled twice for 5 minutes with 75 c.c. of 96 per cent. alcohol, using a reflux condenser, and when cold the spirit is decanted off through a filter. The filtrate is then heated in a retort with 50 c.c. of 50 per cent. aqueous soda until about three-fourths of the spirit has distilled over, the residue transferred to a porcelain dish, and the rest of the spirit removed by evaporation. The aqueous liquid is then extracted by shaking with ether in a suitable apparatus, the ethereal liquid distilled to dryness, and the residue again taken up with a little ether, which is filtered into a small glass and allowed to evaporate slowly. The residue is again dissolved in strong alcohol and allowed to crystallise, when it will be in a sufficiently pure condition for microscopical examination, best with polarised light.

Cholesterol crystallises in very thin, rhombic tablets. Phytosterol, on the other hand, in fascicular, well-formed, fairly broad needles; when crystallised very slowly, the crystals assume the form of six-sided tablets. From undoubtedly pure lard, the authors have sometimes obtained crystals of cholesterol which were not well formed, so as to render the test uncertain. L. DE K.

Fehling's Solution. By J. BISHOP TINGLE (*Amer. Chem. J.*, 1898, **20**, 126—127).—Since ordinary Fehling's solution, unless strongly alkaline, is reduced by mineral acids (compare Jovitschitsch, this vol., ii, 98), the use of the following solution, described by Purdy, is recommended. 4·742 grams of crystallised copper sulphate is dissolved in 200 c.c. of water and 38 c.c. of glycerol, and mixed with 23·5 grams of potassium hydroxide dissolved in 200 c.c. of water; 450 c.c. of ammonia (sp. gr. = 0·9) is added, and the mixture diluted to 1 litre; 35 c.c. of this solution is equivalent to 0·02 grams of dextrose; to determine dextrose, 35 c.c. of the copper solution is diluted with 70 c.c. of water, boiled, and the sugar solution added, drop by drop, until the blue colour is discharged. The copper solution is not reduced by mineral acids, and is unchanged by long keeping. W. A. D.

Estimation of Dextrose. By EDUARD PFLÜGER (*Pfluger's Archiv.*, 1898, **69**, 339—471).—A critical article dealing with the various

methods of estimating sugar, and giving full details of a new method, a preliminary notice of which has already appeared (Abstr., 1897, ii, 378).
W. D. H.

Volumetric Estimation of Grape Sugar and other Substances Oxidisable by Fehling's Solution. By E. RIEGLER (*Zeit. anal. Chem.*, 1898, 37, 22—25).—The method depends on the use of an excess of the Fehling's solution and the titration of the excess of copper by iodine and thiosulphate. Ten c.c. of standard copper sulphate (69·28 grams per litre) is mixed with 10 c.c. of the alkaline tartrate solution (346 grams of sodium potassium tartrate and 100 grams of sodium hydroxide in the litre), and 100 c.c. of water; 2 c.c. of pure concentrated sulphuric acid is added and well mixed in, the mixture is cooled, 1 gram of potassium iodide in 10 c.c. of water is added and a little starch, and the liberated iodine is titrated with N/10 thiosulphate until the blue colour is destroyed and does not reappear for 5 minutes (a reappearance later is to be disregarded). If the thiosulphate is of correct strength, 27·8 c.c. will be required, and each c.c. will correspond with 0·00635 gram of copper.

Fresh quantities of the copper and tartrate solutions diluted with 30 c.c. of water are heated to boiling, 10 c.c. of the sugar solution, which must not exceed 1 per cent. in strength, is run in, and after boiling for a few seconds the precipitated cuprous oxide is filtered off with a dense filter and well washed. The filtrate is acidified and titrated as above, and from the difference between the two titrations the copper precipitated is calculated, and the corresponding amount of grape sugar found from Allihn's table. Test analyses showed satisfactory results. For the estimation of lactose in milk, the proteids must be first removed. This is very neatly effected by using a solution of asaprole in citric acid (30 grams of each per litre); 15 c.c. of this reagent suffices for 10 c.c. of milk, the mixture being made up to 100 c.c., warmed to 60°, and filtered. Twenty c.c. of the filtrate is then treated with the mixed copper solutions as before, the boiling being continued for 6 minutes before filtering. Soxhlet's table gives the amount of lactose corresponding with the copper precipitated.
M. J. S.

Detection and Estimation of Saccharose in Wine. By ARTHUR BORNTRÄGER (*Zeit. anal. Chem.*, 1897, 36, 767—776).—Saccharose is always detected and estimated by inverting with an acid and ascertaining the increase in lævorotation of polarised light and in reducing power, but the proportion of acid to be used, and the time and temperature of heating have been most variously prescribed by different authorities. Of late, the opinion seems to have gained ground that with the large quantity of acid employed by the early experimenters a danger existed of partially reversing the lævorotation of the inverted sugar (compare Bishop, Abstr., 1889, 85). The author confirms the fact of this reversal when the heating is unduly prolonged, but shows that with sugar solutions of the strength employed for Soleil's instrument (16·35 grams per 100 c.c. and stronger solutions are hardly ever met with among sweet wines) the maximum lævorotation is attained when 1/10 volume of hydrochloric acid of sp. gr. = 1·1 (20 per cent.) is added and the temperature is maintained at 67—70° for 10—20 minutes. With the Ventzke solution, however (26·048 grams per 100 c.c.), the maximum is reached at 10 minutes and already at 15 minutes a falling off is observed. The author therefore regards the method which he adopted in 1888 (Abstr., 1890, 426) as free from all objection, especially when it is considered that many hundred samples of sweet wine free from saccharose examined by this method have given practically identical rotations before and after inversion. When the saccharine strength does not exceed that of the Soleil standard, inversion may be completed by leaving the mixture for 18 hours at 18—20°, but with the stronger solution, it is incomplete even at 48 hours. Sweet wines free from saccharose show a slight increase (2·2 degrees Ventzke with a 200 mm. tube) when inverted in the cold, although the reducing power remains unchanged, and since 1 degree Ventzke of lævorotation corresponds with about 0·8 gram of saccharose per 100 c.c. the measurement of the reducing power after cold inversion is the more accurate method of estimating the saccharose present.

M. J. S.

Estimation of Glycogen in the Liver. By A. E. AUSTIN (*Virchow's Archiv.*, 1897, **150**, 185—196).—Brücke's method of preparing glycogen leaves a considerable quantity of that substance in the liver, which can be then extracted by Külz's method. Various objections to the use of the latter method are, however, advanced. A method was therefore devised in which the liver was first subjected to gastric digestion; the amount then obtained was sometimes more, sometimes less, than by Külz's method. Pepsin hydrochloric acid has no action on glycogen.

W. D. H.

Detection of Aldehydes and Phenols. By BARBET and JANDRIER (*Zeit. anal. Chem.*, 1898, **37**, 47—48; from *Ann. Chim. anal.*, **17**, 325).—A few c.c. of a phenol are mixed in a test tube with 2 c.c. of absolute alcohol containing traces of an aldehyde, 1 c.c. of concentrated sulphuric acid is then poured down the side, and the colours observed at the contact surface and after shaking.

With phenol and acraldehyde (a 0·001 per cent. solution), the acid layer is yellow, the alcoholic violet. On shaking, the whole becomes heliotrope-coloured.

Formaldehyde gives no such reaction with phenol; but with gallic acid the lower layer is yellow and the upper blue, and, on shaking, the whole becomes heliotrope-coloured, passing into salmon colour, or with a stronger solution (0·01 per cent.), dirty green. Acraldehyde gives no colour with gallic acid. β-Naphthol, α-naphthol, quinol, and phloroglucinol all give colours with aldehydes, some of the reactions being both characteristic and very sensitive.

M. J. S.

Detection of Chloral Hydrate. By ADAM JAWOROWSKI (*Zeit. anal. Chem.*, 1898, **37**, 60—61; from *Pharm. Zeit. Russ.*, **33**, 373).—A solution of 0·12 gram of resorcinol in dilute aqueous chloral hydrate poured upon dilute sulphuric acid gives a brown ring at the contact surface, and the whole becomes brown on shaking. Strong ammonia floated on the mixture acquires a yellowish-red colour. Aqueous chloral hydrate gives, with Nessler solution, a brick-red precipitate, changing to dirty yellowish-green. Chloral hydrate solution (2 c.c. containing 0·03—0·06 gram) when boiled with 0·3 gram of potassium thiocyanate, and then treated with 3—5 drops of normal potash solution, becomes light brown, and on standing gives a dark brown precipitate with a colourless upper liquor.

A similar experiment with 0·2—0·3 gram of sodium thiosulphate gives a turbid, brick-red liquid, becoming clear and brownish-red when the potash is added. When phloroglucinol is heated with choral hydrate and then treated with potash, it gives a deep brown-red colour; on acidifying with hydrochloric acid after cooling and then shaking with amylic alcohol, the latter becomes brownish-red.

M. J. S.

Estimation of Acetic Acid in the Presence of Inorganic Salts. By Bertram Blount (*Analyst*, **22**, 309—310).—The mixture, which should be free from nitrates, is distilled with dilute sulphuric acid until fumes of the latter begin to make their appearance, the distillate being collected in a receiver containing aqueous soda. It is then evaporated nearly to dryness, and a large excess of absolute alcohol added, which dissolves the sodium acetate and the excess of sodium hydroxide, leaving the sodium chloride and sulphate as an insoluble residue. As the solution still contains some impurities, the alcohol must be evaporated, and the residue re-distilled with dilute sulphuric acid; the distillate is collected in a receiver containing aqueous baryta, and after the excess of baryta has been removed by means of carbonic anhydride, the barium acetate is dried and weighed.

L. de K.

Dissociation of the Salts of Petroleum Acids and the Estimation of Free Acids in Mineral Oils. By Roman Zaloziecki (*Chem. Centr.*, 1897, i, 444; 524—525; *Chem. Rev. Fett. ü. Harz. Ind.*, **4**, 25—27; 36—38).—The author states that the free acidity of mineral lubricating oils is best estimated by means of N/10 soda dissolved in proof spirit.

The soap formed is not decomposed by water, but is hydrolysed to a certain extent when agitated with petroleum. L. de K.

Detection of Margarine. By Hermann Bremer (*Chem. Centr.*, 1897, i, 948; from *Milch. Zeit.*, **26**, 210—211).—It has been proposed to add small quantities of phenolphthalein or dimethylamidoazobenzene to margarine so as to facilitate its detection; the addition of 5 per cent. of sesame oil is recommended by the author, who wishes this to be made compulsory, not only in the case of butter substitutes, but also for lard adulterants. L. de K.

Rapid Detection of Margarine in Cheese. By Rudolf Hefelmann (*Chem. Centr.*, 1897, i, 1002; from *Zeit. öffentl. Chem.*, **3**, 117—120).—Twenty to 50 grams of the rasped cheese is introduced into a tube 20 cm. long and 2·5 cm. wide; 20—25 c.c. of hydrochloric acid of sp. gr. = 1·19 is added, and the tube is then placed in a boiling water bath for about half an hour; the casein dissolves, and the fatty matter floats on the top of the brown liquid. A few drops of the fat are then pipetted off and tested in the butyro-refractometer. If the fat which separates is not quite clear, it must be dissolved by agitating the liquid with light petroleum, when the latter, on evaporation, will leave the fat in a sufficiently pure state. L. DE K.

Examination of Cheese for Foreign Fats (Artificial Cheese) and the Estimation of Water and Fat in Cheese. By ARTHUR DEVARDA (*Zeit. anal. Chem.*, 1897, **36**, 751—766).—The estimation of the volatile fatty acids by the Reichert-Meissl process is a most valuable method of detecting the presence of foreign fats. Although in most cases the true milk fats of cheese show little change after the completion of the ripening process, yet, in consequence of the development of lactic acid and of certain unelucidated changes in the proteids, the fats extracted by ether often show a higher percentage of volatile fatty acids than is the case in butter. The following method of extraction avoids this source of error. About 50—100 grams of the cheese, cut into small fragments or rubbed up with a little water in a mortar, is placed in a Wolfbauer's flask (a double flask shaped like a figure 8) with 50—80 c.c. of water, 100—150 c.c. of ether, and a drop of phenolphthalein. After vigorous shaking, dilute potash is added until a pink colour is obtained, and the flask is again well shaken. The ethereal layer is filtered and distilled, and the fat, after drying at 100°, is, if necessary, again filtered. In about 45 specimens of genuine cheese, the Reichert-Meissl number ranged from 23·1 to 32·6, only two specimens (a Limburg, and a Swiss green cheese) showing lower numbers (20·1 and 15·4 respectively, with the abnormally low saponification number 216), whilst the four artificial cheeses examined gave only 1·7—3·1.

The best method of estimating the water is to expose 10 grams of the cheese, cut into small pieces, in a vacuum over sulphuric acid at the ordinary temperature for 24—36 hours, and to finish by 2—6 hours at 100°. The loss of volatile acids is by this means reduced to a minimum, and the cheese is left in a porous condition, in which state it is easily pulverised without adding sand, and is very readily extracted with ether. The ether extract rarely contains notable proportions of non-fatty organic matters. The crude fats may be partially purified by redissolving in cold ether, or by shaking the ethereal solution with water or dilute alkali. Light petroleum presents no advantage over ether for the extraction of the fats.

M. J. S.

Glucosides contained in Digitalis Leaves, and their Estimation. By C. C. KELLER (*Chem. Centr.*, 1897, i, 1211; from *Ber. Pharm. Ges.*, 1895, Heft 11).—According to the author, the leaves of digitalis contain the three glucosides, digitoxin, digitonin, and digitalin, which are identical with the glucosides contained in the seeds. To estimate the quantity of digitoxin, the leaves are extracted with 70 per cent. alcohol, the solution evaporated, the residue taken up with water, basic lead acetate added, the lead removed from the filtrate by sodium sulphate, the solution made alkaline with ammonia, and shaken with chloroform. The digitoxin thus extracted is purified by means of a mixture of ether and chloroform (3 : 7) in light petroleum.

It forms a yellow solution in hydrochloric acid, which, when heated to 100°, becomes green and then yellowish-green. When a solution of digitoxin in glacial acetic acid containing ferric chloride is treated with concentrated sulphuric acid, the zone of demarcation of the two liquids becomes dark, and in a few minutes the acetic acid turns indigo-blue (Keller's test). The red coloration obtained by treating digitoxin with concentrated sulphuric acid is probably due to the presence of traces of digitalin. The above process may be used for the valuation of digitalis.

Digitonin is obtained from the aqueous solution after shaking with chloroform, by expelling the ammonia, acidifying with hydrochloric acid, precipitating with tannin, dissolving the tannates in 50 per cent. alcohol, adding lead oxide, evaporating, extracting the residue with dilute alcohol, filtering, and evaporating the solution to dryness. Digitonin, when submitted to Keller's test, gives a bright red coloration.

Digitalin is obtained from the filtrate from the digitonin tannates as follows. More tannin solution and concentrated sulphuric acid are added, the precipitate dissolved in 70 per cent. alcohol, the solution boiled with lead carbonate, the liquid decanted, evaporated with lead oxide, the residue extracted with alcohol, and the solution evaporated. Digitalin, when tested by Keller's reaction, gives a characteristic red zone.

For pharmaceutical purposes, it is sufficient to determine the content of digitoxin. E. W. W.

Influence of certain Drugs on the Analysis of Urine. By Bruno Bardach (*Zeit. anal. Chem.*, 1897, 36, 776—784).—*Influence of Nitrates on the Estimation of total Nitrogen.*—Whether the original method of Kjeldahl or the special modification of Jodlbauer and Förster is employed, not only is the nitrogen of the nitrate missed, but considerably less is found than is present in other forms. This is due to the intermediate formation of nitrous acid, which then decomposes urea with evolution of nitrogen. By reducing the nitrates with aluminium and soda before adding the sulphuric acid, the total nitrogen present may be estimated with great accuracy. For 10 c.c. of urine, 0·3 gram of ignited aluminium foil and 5 c.c. of soda of sp. gr. = 1·34 may be used. The reduction is allowed to proceed for $\frac{3}{4}$-hour in the cold, and the liquid is then carefully boiled for 5 minutes, and air is aspirated through the flask for $\frac{3}{4}$-hour longer, the gases being passed through standard acid with precautions against the transport of soda by the hydrogen. The concentrated sulphuric acid (30 c.c.) is then added, and the process finished as described by Kjeldahl. To ensure the complete absorption of the ammonia, it is desirable to pass the hydrogen twice through acid.

Titration of Urea by Liebig's Method.—In presence of iodides, the end-reaction occurs too soon, although this effect can to some extent be compensated by the addition of sodium chloride. Ammonium chloride, on the contrary, delays the end-reaction very seriously.

Estimation of Uric Acid.—Salkowski's method (Abstr., 1872, 333) is not appreciably influenced by piperazine, lysidine, or potassium iodide, in the proportions of the ordinary doses. M. J. S.

Estimation of Alloxuric Bases. By Ernst L. Salkowski (*Pflüger's Archiv.*, 1898, **69**, 268—306).—The paper proposes certain modifications of the silver method of estimating uric acid and the alloxuric (xanthine) bases, and criticises Camerer's work on the subject.

W. D. H.

The Krüger-Wulff Method for Estimating Alloxuric Compounds. By Ernst L. Salkowski (*Chem. Centr.*, 1897, i, 1076—1077; from *Deutsch. med. Woch.*, **23**, 213—216).—The author thinks that his process, involving the use of silver solution, is preferable to the method based on the action of a cuprous salt; silver throws down the alloxuric bases, all but completely.

L. de K.

Estimation of Caffeine in Coffee. By Arthur Forster and Rudolf Riechelman (*Chem. Centr.*, 1897, i, 1259—1260; from *Zeit. öffentl. Chem.*, **3**, 129—131).—Twenty grams of the ground roasted coffee is boiled four times with 200 c.c. of water, and after the joint infusions have been made up to 1 litre and filtered, 600 c.c. of the filtrate is extracted in a specially constructed apparatus for 10 hours with chloroform, the liquid having previously been made alkaline with aqueous soda. The chloroform is distilled off, the residue treated by Kjeldahl's process, and the amount of caffeine calculated.

The liquid also contains another alkaloid, which although it cannot be extracted by an immiscible solvent, may be precipitated by phosphomolybdic acid. This alkaloid may be obtained from the precipitate by treating it with lime and extracting with alcohol; probably it is identical with Paladino's caffeearine.

L. de K.

Estimation of Caffeine in Tea. By C. C. Keller (*Chem. Centr.*, 1897, i, 1134—1135; from *B. Pharm.*, **7**, 105—112).—Six grams of the sample is treated in a separating funnel with 120 grams of chloroform, and after soaking for a few minutes, 6 c.c. of a 10 per cent. solution of ammonia is added, and the whole shaken for half an hour. After leaving it for 3 to 6 hours, 100 grams of the chloroform extract, representing 5 grams of tea, is drawn off, distilled to dryness, and the residue moistened with 3 c.c. of absolute alcohol; this, when evaporated in a strong current of air, causes the chlorophyll to separate mechanically. The caffeine is purified by warming it with a mixture of 7 c.c. of water and 3 c.c. of alcohol; 20 c.c. more water is then added, and the liquid filtered. On evaporation, it leaves pure, weighable caffeine.

The percentage of caffeine in various commercial samples of tea is tabulated.

L. de K.

Reagents for the Detection of Certain Alkaloids. By Alphonse L. Brociner (*Zeit. anal. Chem.*, 1898, **37**, 62; from *Pharm. Zeit. Russ.*, **28**, 778).—A solution of 1 gram of potassium perruthenate in 20 c.c. of concentrated sulphuric acid gives the following colorations:—with *solanine*, a gradually developing red colour, which disappears on heating; with *ononine*, an immediate brownish-red; with *chelidonine*, green; with *imperatorine*, blue changing to green. A solution of 1 gram of ammonium uranate in 20 c.c. of sulphuric acid (which must be freshly prepared) gives:—with *codeine*, a blue coloration on gently warming; with *imperatorine*, blue disappearing on warming; with *morphine*, a dirty green on warming; and with *chelidonine*, a slowly developing green coloration. M. J. S.

Detection of Opium Alkaloids. By Gustave Bruylants (*Zeit. anal. Chem.*, 1898, **37**, 62—63; from *Pharm. Zeit. Russ.*, **28**, 778).—The following colour reactions are given by the various opium alkaloids with the Fröhde-Buckingham reagent and the modifications of the test suggested by the author (Abstr., 1896, ii, 132).

	Fröhde reagent in the cold.	Fröhde reagent after warming.	Potassium nitrate added to hot mixture.
Morphine	Violet.	Green.	Red, then yellow.
Apomorphine	Greenish-blue.	*Ibid.*	*Ibid.*
Oxymorphine	Blue.	*Ibid.*	The violet changes to red.
Codeine	Dirty green, then blue.	*Ibid.*	Like morphine.
Narceine	Blue changing to green.	Dirty green.	Like morphine.
Narcotine	Green, then greenish-brown.	Green.	Violet, then transient red.
Papaverine	Green, then blue, then red.	Green, then blue, then red.	Green rapidly disappearing.
Meconine	Very transient green.	Dirty blue.	*Ibid.*
Cryptopine	Dirty green, then greenish-brown.	Dark brown.	*Ibid.*

M. J. S.

Estimation of Morphine in Opium. By Clemente Montemartini and D. Trasciatti (*Gazzetta*, 1897, **27**, ii, 302—335).—Most of the test estimations of morphine in opium by various methods have been made on a few samples of opium of approximately the same composition. The authors have determined the morphine in nine samples of opium (A to K), differing widely in composition, by the principal methods, the results being summarised in the accompanying table; the best were obtained by a method which the authors themselves have elaborated, depending on extracting the morphine with a sodium chloride solution. Theanalysis is carried out as follows. Ten grams of the powdered opium, dried at 100° is macerated in a mortar with 90—100 c.c. of a 20 per cent. sodium chloride solution for 1 hour, and then thrown on to a small filter, the residue being again treated for 1 hour with 60 c.c. of the sodium chloride solution. The mixture is then filtered, and the residue repeatedly treated with sodium chloride solution until a colourless filtrate is obtained, or until a drop gives no reaction with Fröhde's reagent. The mixed filtrates are evaporated to dryness on the water bath, and the powdered residue is repeatedly extracted with boiling absolute alcohol (300—350 c.c.) until the extract gives no reaction with Fröhde's solution; the alcoholic solution is evaporated, and the residue, after being covered with 15 c.c. of very dilute ammonia and left for 24 hours, is collected on a tared filter, washed with aqueous morphine solution until the washings are colourless, and dried at 100°. The filter containing the morphine is then put into a tap funnel and covered with chloroform; the latter is run off and the treatment repeated until, on evaporating a few drops, taking up the residue with hydrochloric acid and adding soda, no turbidity is obtained. The morphine is then again brought on to a tared filter, dried at 100°, and weighed; the whole determination takes about 4 days for its completion.

Sample.	Italian Pharmacopœia of 1892.	Helfenberger.		Langlois.	Guichard.	Cannapin and Van Eijk.	Perger.	Squibb.	With NaCl.
		Aliquot parts.	With exhaustion.						
A.	14·35	11·05	10·46	—	—	10·94	16·84	—	16·70
B.	12·30	11·40	11·52	—	—	11·76	15·60	15·02	15·80
C.	10·10	7·68	10·28	10·09	14·36	10·76	12·29	12·40	12·00
D.	6·40	5·10	4·40	5·89	—	6·74	8·60	10·85	8·36
E.	10·12	10·15	10·44	11·60	11·70	11·42	13·04	13·11	13·55
F.	4·08	—	—	—	—	—	8·77	8·89	8·67
G.	—	—	—	—	—	13·00	—	16·09	16·55
H.	—	—	—	5·53	19·42	5·84	11·37	11·07	11·42
K.	7·36	—	—	9·58	14·24	10·12	12·82	13·58	13·51

The most concordant results are obtained by this method and by those of Perger and Squibb. W. J. P.

Detection of Atropine in Corpses. By Paul Soltsien (*Chem. Centr.*, 1897, **1**, 1002; from *Zeit. öffentl. Chem.*, **3**, 115—116).—In the case of a child who died through eating atropine pills, this alkaloid could not be detected in the alkaloidal residue obtained from the kidneys, liver, and spleen, either by the physiological test or by Vitali's reaction; neither could any atropine be obtained from the stomach or its contents, or from the duodenum or œsophagus. In the urine, however, a trace of alkaloidal residue was obtained which, although it could not be detected by Vitali's reaction, gave a very good physiological test when applied to the eye. L. de K.

The Precipitation of Proteids. By N. C. Henrik Schjerning (*Zeit. anal. Chem.*, 1897, **36**, 643—663).—A marked difference is produced in the properties of albumin and other proteids by the presence or absence of saline matter, the ash-free proteids evidently possessing, in some respects, the character of acids. The precipitation of the proteids by the four reagents employed by the author (Abstr., 1896, ii, 631), namely, stannous chloride, lead acetate, ferric acetate, and uranium acetate, may therefore be regarded as resulting from the formation of insoluble protein salts of the heavy metal. To investigate the question whether these precipitations would be furthered by the presence of normal salts, containing in the first place a different basic radicle, and in the second case a different acid radicle from that in the precipitant, two series of experiments were made, employing beer as the proteid solution and working strictly according to the methods laid down in former papers. In the first series, varying amounts of a calcium salt were added before the precipitating reagent, the acid radicle of the calcium salt employed being in each case identical with that of the precipitant. The result was that the amount of nitrogenous matter precipitated by stannous chloride increased with increasing additions of calcium chloride but with the three other reagents the reverse effect was produced. On this account, it is advocated as an improvement in the precipitation of albumin by stannous chloride to add 10 c.c. of a 10 per cent. calcium chloride solution, and to wash the precipitate with a 1 per cent. solution of the same. In the second series, a new acid radicle was introduced (or rather the amount already present was augmented) by the addition of sodium phosphate. Up to a certain point, this caused an increased precipitation of nitrogenous matter by each reagent, but as soon as the added phosphate was sufficient to precipitate the reagent by itself, the amount of nitrogenous matter thrown down diminished.

The addition of phosphate is therefore only desirable in cases where the proteid solution is very deficient in phosphoric acid, and then only to the amount existing in normal beer, namely, about 0·02 gram of P_2O_5 in 25 c.c. These cases may be recognised by the incomplete precipitation of the ferric acetate by the original solution.

The author has now applied the above method of analysis to solutions of egg-albumin, milk, decoction of yeast, Witte's peptone, Liebig's meat peptone, and meat extract, diastase (Merck's) and urine. The results indicate that whereas beer-wort seems to contain only four proteids, milk contains a fifth, which is not precipitable by stannous chloride, but is precipitated by all the other reagents, including magnesium sulphate. This, which the author distinguishes as albumin II, seems to agree in amount with the lactalbumin and lactoglobumin of König, whilst the albumin I precipitable by stannous chloride agrees closely with the amount of casein. Witte's peptone and Liebig's meat peptone contain propeptones (albumoses), but no peptones; Liebig's meat extract shows 11 per cent. of the nitrogen in the form of peptones, whereas König and Bömer found only traces (Abstr., 1896, ii, 83). In normal urine only traces of proteids are discoverable. M. J. S.

Modification of Oliver's Hæmoglobinometer. By Ernest Solly (*Proc. Physiol. Soc.*, 1897—8, 23).—Instead of using a dark room, a box acting as a portable dark chamber which can be illuminated with a small candle or electric lamp is employed, and modification in the extent of dilution of the blood is also suggested. W. D. H.

General and Physical Chemistry.

Refractivities of Air, Oxygen, Nitrogen, Argon, Hydrogen, and Helium. By WILLIAM RAMSAY and MORRIS W. TRAVERS (*Proc. Roy. Soc.*, 1897, **62**, 225—232).—By means of an apparatus similar to that described by Lord Rayleigh (Abstr., 1896, ii, 598), the refractivity of hydrogen was compared with that of air, and subsequently the hydrogen was compared with oxygen and with nitrogen free from argon. Air, oxygen, and nitrogen, were then compared with one another, and with argon. Placing air in each case equal to unity, and calculating the refractivities of the other gases, the following table was obtained.

	Directly	Through			
	Compared.	Oxygen.	Nitrogen.	Hydrogen.	Argon.
Hydrogen.........	0·4733	0·4737	0·4727	—	—
Oxygen............	0·9243	—	0·9247	0·9237	0·9261
Nitrogen	1·0163	1·0155	—	1·0170	1·0191
Argon	0·9596	0·9577	0·9572	—	—
CO_2	—	1·5316	—	—	—

It has been tacitly assumed that the refractive index for a mixture of gases is that of those of their constituents, taken in the proportion in which they occur. The index of refraction of air, calculated from the above determinations, is about 0·35 per cent. too low, that of a mixture of about equal volumes of hydrogen and helium is 3 per cent. higher than the value found, and a mixture of oxygen and carbonic anhydride has a calculated refractivity that is less than the observed.

The effect of mixing equal volumes of hydrogen and helium, each of which has too large a coefficient of elasticity, is to cause each to occupy twice the volume that they previously occupied, and to halve approximately the pressure for each. The pressure is therefore lower than it would be for an absolutely ideal gas, for each gas, hydrogen and helium. The sum of these pressures will accordingly be too low, or transposing, the sum of the volumes will be too great. The opposite argument holds for air. But if the refractive power is a function of the dielectric constant, and hence of the co-volumes of the gases, it follows that gases are not, as postulated by Dalton, indifferent to one another's presence, but that they modify one another's properties in the same manner as do liquids, although to a different extent. Although at low pressures and large volume, measurements of pressure and volume may not be accurate enough to lead to the detection of this mutual action, the refractivity seems to be a means delicate enough to be used for this purpose. H. C.

Optical Constant of Sodium. By PAUL DRUDE (*Ann. Phys. Chem.*, 1898, [ii], **64**, 159—162).—With light polarised at an angle of 45° to the plane of incidence, an angle of incidence of 65°, and using sodium light, the author finds for the index of refraction of sodium $n = 0·0045$, and for that of absorption $k = 580$. Sodium has therefore the smallest index of refraction found for any metal. H. C.

Refractive and Dispersive Power of Combined Silicon. By GINO ABATI (*Gazzetta*, 1897, **27**, ii, 437—455).—The author has determined the refraction constants of a number of silicon compounds for the rays H_α, H_β, H_γ, and D; the chief results for the ray H_α are summarised in the accompanying table. The substances were examined in the pure state with the exception of colloidal silicic acid, which was examined in a 2·153 per cent. aqueous solution. The atomic refraction of silicon calculated by either the μ or μ^2 formula varies considerably in the different compounds. W. J. P.

Compound.	t.	d at $t°$.	$P\frac{\mu_{H_\alpha} - 1}{d}$	$\frac{P}{d}\frac{\mu^2_{H_\alpha} - 1}{\mu^2_{H_\alpha} + 2}$	Atomic refraction of silicon for	
					μ.	μ^2.
$SiCl_4$	22·9°	1·47556	47·26	28·55	8·06	4·47
$SiBr_4$	23·5	2·77222	70·07	40·48	8·87	4·68
$SiEt_4$	22·3	0·76819	79·62	47·91	13·62	7·27
$SiEt_4$	22·7	0·76890	79·38	47·77	13·38	7·13
$Si(OMe)_4$	22·0	1·02804	54·11	33·09	7·31	4·37
$Si(OEt)_4$	20·0	0·9320	84·84	50·52	7·64	3·56
$Si(OPr)_4$	22·7	0·9158	115·18	69·81	7·58	4·61
$Si_2O(OPr)_6$	22·6	0·97694	176·88	107·02	6·04	3·82
$Si(OH)_4$	24·1	—	26·44	16·21	10·04	5·73
Quartz	0	2·65085	12·36	7·16	6·76	4·00
Tridymite	15	2·304	12·39	7·34	6·79	4·18
Opal	15	2·15	11·56	—	5·96	—

Refractive Indices of the Blue and Green Solutions of the Chrome Alums. By CHARLES SORET, ARN. BOREL, and EUG. DUMONT (*Chem. Centr.*, 1897, i, 1088; from *Arch. Sci. phys. Genève*, [iv], 3, 376—381).—Observations were taken with 4 to 6 per cent. solutions of potassium and ammonium chrome alum for the rays C, D, and F. The mean refractive index of the blue solutions is greater than that of the green solutions by 47 units of the fifth decimal. The difference is the same for solutions of both the alums. The observations were made at about 20°. H. C.

Refraction of Metallo-carbonyls. By RAFFAELE NASINI (*Gazzetta*, 1897, **27**, ii, 556—559).—The author objects to Ferreira da Silva's statement (Abstr., 1897, ii, 406) of the views of Mond and Nasini, respecting the metallo-carbonyls. W. J. P.

Optical Activity. By L. TCHÚGAEFF (*Ber.*, 1898, **31**, 360—368).—The author considers that for comparisons of the optical activities of different substances, it is better to use the molecular rotation, $[M]_D = M \times [\alpha]_D$, and not the usual constant, the specific rotatory power $= [\alpha]_D$.

The following numbers have been obtained for the different menthylic salts of normal acids.

	$[\alpha]_D$.	$[M]_D$.	d 20°/4°.	B. P. at 15 mm.
Menthol	−50·0°	−78·0		
Menthylic formate...........	−79·52	−146·3	0·9359	98°
,, acetate	−79·42	−157·3	0·9185	108
,, propionate	−75·51	−160·2	0·9184	118
,, butyrate	−69·52	−156·9	0·9114	129
,, valerate	−65·55	−157·3	0·9074	141
,, hexoate...........	−62·07	−157·7	0·9033	153
,, heptoate	−58·85	−157·7	0·9006	165
,, octoate	−55·25	−155·8	0·8977	175

The salts were obtained by the action of the various acid chlorides, in slight excess, on menthol; the products were washed with sodium hydroxide, dissolved in ether, dried with potassium carbonate, and, after distilling off the ether, carefully fractionated under diminished pressure. The portions taken for the optical constants boiled within a few tenths of a degree. The measurements were made in a Laurent half shadow polarimeter at a temperature of 20—20·5°. The tube used was 100 mm. long. The most important generalisation which can be drawn is, that whilst the function $[\alpha]_D$ is at a maximum with the formate and then gradually gets smaller, the function $[M]_D$ reaches its maximum with the acetate, and then remains practically constant.

A similar result is obtained when the specific rotatory powers of the salts of *l*-amylic alcohol given by Guye and Chavanne (Abstr., 1895, i, 202, 317) are converted into the corresponding molecular rotations. A maximum is reached at amylic propionate, and the higher members of the series have roughly the same molecular rotation, namely, −4·33°.

Similar results may be obtained for other homologous series, namely, alkylic salts of optically active valeric acid (Guye and Chavanne, Abstr., 1893, ii, 561), the derivatives of *l*-menthylamine (Binz, *Inaug. Diss.*, 1893), the ethereal salts of glyceric and of diacetylglyceric acid, Frankland (Trans., 1893, 511, 1410; 1894, 750), and also the alkylic salts of tartaric acid (Pictet and Freundler).

In the different series, the maximum is reached at very different points; in some cases near the beginning of the series, in others towards the end. In certain series, the maximum appears to lie beyond any members of the series hitherto investigated. In series in which a change in the sign of the rotation occurs, it seems probable that no maximum and no constant molecular rotation will be found.

J. J. S.

Fluorescence and Chemical Constitution. By Richard E. Meyer (*Ber.*, 1898, 31, 510—514).—The author has endeavoured to bring into line the numerous facts relating to fluorescence, and has traced the phenomenon to the presence of certain groups which he designates as fluorophores (this vol., ii, 105). The applicability of these generalisations has been called in question by Pawlewski (this vol., i, 322), to whom the present paper constitutes a reply.

The author describes a simple form of apparatus which has been found useful in the demonstration of fluorescence phenomena.

M. O. F.

Variation of the Electromotive Force of Different Forms of the Clark Standard Cell with Temperature and with Strength of Solution. By Hugh L. Callendar and H. T. Barnes (*Proc. Roy. Soc.*, 1897, **62**, 117—152).—The authors describe a lengthy series of experiments carried out with different forms of the Clark standard cell. A modification has been adopted, which is termed the Board of Trade "crystal" cell, in which the cell above the mercurous paste is filled with moist crystals, instead of with saturated solution. These cells have no appreciable diffusion-lag, and are not surpassed in quickness by any other form. Over the range 0° to 28°, we may take the formula $E_t = E_{15} - 0{\cdot}001200(t-15) - 0{\cdot}0000062(t-15)^2$, as representing the temperature variation of the E. M. F. of these cells within about one-twentieth of a millivolt between these limits. Several forms of hermetically sealed cells are described of a W or an inverted Y pattern. Determinations have been made of the densities of zinc sulphate solutions and of the solubility of zinc sulphate at different temperatures. At about 38·8°, a break in the solubility curve, and a change in the continuity of the curve representing the temperature variation of the E. M. F. were observed, and referred to the change of the hydrate $ZnSO_4 + 7H_2O$ to the hydrate $ZnSO_4 + 6H_2O$ (compare Jaeger, this vol., ii, 202).

H. C.

A New Kind of Transition Cell. By Ernst Cohen (*Zeit. physikal. Chem.*, 1898, **25**, 300—304).—The author described (Abstr., 1894, ii, 340) an electrical cell in which an E. M. F. is produced by means of electrodes placed in saturated solutions of the two forms of a compound capable of undergoing a transition change, and an element where the temperature coefficient changes abruptly at the transition temperature (Abstr., 1894, ii, 407). Another class of cell is of the following type. Electrode reversible with respect to the anion | saturated solution in presence of stabile solid phase | electrode reversible with respect to the cation. Such a cell is the Clark cell, consisting of mercury in mercuric sulphate, | saturated solution of zinc sulphate, | zinc, and in this cell the temperature coefficient should change abruptly at the temperature of transition from $ZnSO_4 + 7H_2O$ to $ZnSO_4 + 6H_2O$. Callendar and Barnes (preceding abstract) found this temperature to be 38·75°; solubility experiments gave the value 39·3°, and by the dilatometric value the temperature 38·5° was obtained.

L. M. J.

Action of Drop-electrodes. By Wilhelm Palmaer (*Zeit. physikal. Chem.*, 1898, **25**, 265—283).—During the formation of the drop in a mercury-dropping electrode the surface of separation of mercury and calomel solution is increased, and hence, if the solution tension of the mercury is less than the pressure of the mercury ions, the latter pass into the drop, whilst the equivalent quantity of chlorine ions form the double layer at the surface until the normal potential difference is reached. When this drop reaches the lower surface of mercury, already in its normal state, the mercury and chlorine ions again pass into solution reforming calomel, so that it follows that the concentration of the calomel decreases above and increases below. By independent mercury electrodes in the electrolyte at the upper and lower portions, and a mercury electrode in an independent calomel solution, the concentration was found to change in the manner expected. The potential difference soon attains a constant value, and, if the dropping be then stopped, the E. M. F. falls, slowly if undisturbed, but immediately if the liquid be stirred. Owing to the formation of a mercury emulsion in the liquid, the liquid does not reach a normal state, even by remaining 24 hours without stirring. The effect of change of level of the electrode, diameter of dropping-tube, and head of mercury were investigated, and the concentration of the mercury ions in the neighbourhood of the dropping-tube was found to be about one-tenth that of a saturated calomel solution, that is, about 1·1 × 10·7 normal.

L. M. J.

Electric Conductivity of Nitric Acid. By VICTOR H. VELEY and J. J. MANLEY (*Proc. Roy. Soc.*, 1897, **62**, 223—225).—Determinations were made of the electric conductivity of nitric acid of percentage concentrations varying from 1·3 to 99·97, purified, as far as possible, from the reduction products of the acid and other impurities. A considerable quantity of the practically anhydrous, 99·97 per cent., acid was prepared, and some of the properties of this examined. It has no action on (i) copper, (ii) silver, (iii) cadmium, or (iv) mercury, all of high degree of purity, or (v) commercial magnesium, at ordinary temperatures; purified iron and commercial granulated tin were not affected by the acid, even when boiling. Purified zinc was slightly acted on, but sodium immediately caught fire. The acid has no action whatever on calcium carbonate at ordinary temperatures or the boiling point. Flowers of sulphur and iron pyrites dissolve quickly in the gently-warmed acid. The following results were obtained for the density of the 99·97 per cent. acid, corrected for weighing in a vacuum. Density, 4°/4° = 1·54212; 14·2°/4° = 1·52234; 24·2°/4° = 1·50394.

The specific resistance decreases for percentage concentrations from 1·30 to 30, at first more, then less rapidly; from this point the resistance increases slowly up to 76 per cent., thence more rapidly until a maximum is reached at 96·12 per cent., when a sudden reversal takes place. There is a positive temperature coefficient of conductivity for percentage concentrations from 1·3 to 96·12, but from this point up to 99·97 per cent., the acid has a negative coefficient. As nitric acid of 96—99·97 per cent. would contain few, if any, free ions, this result is opposed to the theory of ionic dissociation. On the other hand, points of discontinuity are shown on the conductivity curve corresponding approximately with the composition required for the hydrates $HNO_3 + 2H_2O$, $HNO_3 + H_2O$, $2HNO_3 + H_2O$, and $HNO_3 + 10H_2O$.

H. C.

Energy of some Toluenesulphonic and Xylenesulphonic Acids. By P. BONOMI DA MONTE and A. ZOSO (*Gazzetta*, 1897, **27**, ii, 467—475).—The authors have examined toluene-ω-sulphonic acid,

$C_6H_5\cdot CH_2\cdot SO_3H$, paraxylene-ω-sulphonic acid, $C_6H_4Me\cdot CH_2\cdot SO_3H$, tolueneparasulphonic acid, $C_6H_4Me\cdot SO_3H$, and paraxylenesulphonic acid, $C_6H_3Me_2\cdot SO_3H$, determining the electrical conductivity of their aqueous solutions, the speed with which they invert cane-sugar, and their cryoscopic behaviour. All four acids are nearly wholly electrolytically dissociated in aqueous solutions of moderate dilution, and have about the same affinity constant as hydrochloric acid. The values of μ_∞ for the four acids in the order named above are 350·98, 350·01, 350·49, and 350·38, the corresponding values for the sodium salts being 75·18, 74·21, 74·69, and 74·58 respectively. The differences observed between the acids are so small that no influence can be at present assigned to the position of the methyl groups. W. J. P.

Energy of some Bases of Mixed Function. By Giacomo Carrara and U. Rossi (*Gazzetta*, 1897, **27**, ii, 505—532).—The authors have determined the electrical conductivites of a number of betaine and thetine compounds, the experimental data being summarised in the accompanying table.

Substance.	μ_{1024}.	μ_∞.	Mean value of K_a/K_e.
Betaine hydrochloride	111	—	·78·7
,, hydrobromide	114	115·8	100·2
Dimethylthetine hydrochloride	115	116·9	38·1
,, hydrobromide	—	119·7	26·5
Diethylthetine hydrochloride	103	105·2	50·0
,, hydrobromide	106	107·8	40·3
Dimethyl-α-propionylthetine hydrochloride	103	105·2	36·4
,, ,, ,, hydrobromide	105	108	34·4
,, -β- ,, hydrobromide	105	108	2248
Diethylselenetine hydrobromide	105	108	27030
Ethylic dimethylthetine bromide	103·93	108	—
Triethylsulphine chloride	102·2	105·8	—

The electrical conductivities of the hydrochlorides and hydrobromides of betaine, dimethyl- and diethyl-thetine, and dimethyl-α-propionylthetine are of the same order of magnitude as those of hydrogen chloride and bromide, especially in dilute solutions; the behaviour of diethylselenetine, dimethyl-α-propionylthetine, and the ether of dimethylthetine is different, these substances undergoing much less hydrolysis.

Substance.	*AC.*	*K.*
Hydrogen chloride or bromide	0·000286	—
Dimethylthetine hydrobromide	0·000152	0·00571
,, hydrochloride	0·000157	0·00523
Betaine hydrochloride	0·000103	0·0172
,, hydrobromide	0·000101	0·0181
Dimethyl-α-propionylthetine hydrochloride	0·000150	0·00604
,, hydrobromide	0·000027	0·355

The authors have also determined the affinity constants of the various bases by Walker's method, which consists in heating a solution of the hydrochloride or hydrobromide of the base with methylic acetate at 25—26°, withdrawing samples from time to time, and titrating against standard potash; x is the quantity of methylic acetate hydrolysed in t minutes, A the quantity originally present and the reaction is a monomolecular one obeying the equation $\log \frac{A}{A-x} = \frac{AC}{t}$. If K_a be ten times the affinity constant obtained with hydrogen chloride or bromide, K_1S ten times the affinity constant obtained with the hydrolysed salt, and K the affinity constant of the base, then $K = (K_a - K_1S)/K^2{}_1S$. The accompanying table gives the vales of AC and K obtained. Comparison of the figures given with those obtained by Walker shows that the betaine and thetine bases are more powerful than thiocarbimide, carbimide, or acetamide, and less powerful than asparagine or glycocine. W. J. P.

Dielectric Constants of certain Organic Substances at and below the Temperature of Liquid Air. By JAMES DEWAR and JOHN A. FLEMING (*Proc. Roy. Soc.*, 1897, 61, 358—367. Compare this vol., ii, 9).—The authors have examined formic acid, methylic alcohol, amylic alcohol, quinoline, tetrethylammonium hydroxide, and phenol, and find that these substances have in the liquid or solid condition, and at temperatures above −100°, high or very high dielectric values, but all have their dielectric constants reduced to a value not far from 2·5 when they are cooled to the temperature of liquid air. The dielectric constants of castor oil and olive oil are reduced in value when these oils are cooled to −185°. Carbon bisulphide, ether, ethylic nitrate, a solution of sulphur in carbon bisulphide, and a 10 per cent. solution of metallic sodium in absolute alcohol all undergo a reduction in the value of the dielectric power, large or small, which these substances possess at normal temperatures. The presence of the radicles hydroxyl, carbonyl, and carboxyl, always produces relatively high dielectric values in the substances containing them, when these are in the liquid state, and at temperatures not very far below their freezing points. When these substances are, however, frozen and cooled to the temperature of liquid air, all of them suffer a reduction in dielectric power, and their dielectric constants are reduced to values not far from 2·5 at the temperature −185° or a little below. The action of the low temperature is thus to annul the effect of the radicle. No exception has so far been found to the rule that pure organic substances have a dielectric constant of from two to three times that of vacuous space when they are cooled to the temperature of boiling liquid air, no matter what value their constant may have when in the liquid condition.
H. C.

Dielectric Constants of Metallic Oxides dissolved or suspended in Ice Cooled to the Temperature of Liquid Air. By JAMES DEWAR and JOHN A. FLEMING (*Proc. Roy. Soc.*, 1897, 61, 368—379).—The presence of cæsium hydroxide, lithium hydroxide, bismuth oxide, aluminium oxide, finely divided sulphur, or finely divided gold in ice was found to make little or no difference in its dielectric power when cooled to the temperature of liquid air. The presence, to about the same extent, of the hydroxides of potassium, sodium, rubidium, or the oxides of copper, iron, or lead, causes a very great increase in the dielectric power of the ice at that low temperature. The dielectric curves are, however, all seen to be tending downwards in such a way as to show that at still lower temperatures it is probable the effect of the oxides or hydroxides would be annulled and the dielectric constants of all be reduced to a value not far from that of pure ice. The exception to this tendency, so far as yet observed, appears to be in the case of the oxide of copper, which, when suspended in ice, causes it to possess the remarkably high dielectric value of 150 even at the temperature of liquid air. It is possible, however, that in this case the conductivity of the yet insulated particles of oxide may account for the result. The effect of the solvent is also exceedingly marked. Oxide of copper suspended in ice has a dielectric value of about 150 at − 185°, oxide of lead suspended in ice has a value of about 80 at the same temperature. If, however, the oxide of copper is dissolved in ammonia and frozen, the dielectric constant of this at − 185° falls to 2·2, whereas if the oxide of lead is dissolved in 5 per cent. solution of potassium hydroxide and frozen, the dielectric constant rises to 170 at the temperature of liquid air.

The only general conclusion that can as yet be drawn is that the presence of certain oxides or hydroxides of metals in ice, even to the extent of not many per cent., has an immense influence in raising the dielectric power of the ice when taken at the temperature of liquid air, whereas the presence of other oxides or hydroxides chemically analogous has hardly any influence at all. H. C.

Dielectric Constants of Frozen Electrolytes at and above the Temperature of Liquid Air. By JOHN A. FLEMING and JAMES DEWAR (*Proc. Roy. Soc.*, 1897, **61**, 380—396. Compare this vol., ii, 8).—As regards the value of the dielectric constants of frozen electrolytes at the temperature of liquid air, the salts examined may be divided into three broad classes.

I. Those which, when added to water in percentages from 5 to 50, do not much affect the dielectric constant of the water when it is frozen, and, at the temperature of liquid air, have dielectric constants not far from 2·5, or lying between 2 and 3. Such salts are sodium hydrogen carbonate and sulphate, potassium hydrogen carbonate and sulphide, potassium dichromate and iodide, sodium chloride and nitrite, barium chloride and cupric carbonate. These include the acid salts and halogen salts.

II. Those salts which, when added to water in percentages from 5 to 50, raise the dielectric constant of the water somewhat, and yield frozen electrolytes having, at the temperature of liquid air, dielectric constants lying between 3 and 10, that of pure ice at the same temperature being 2·5. Such salts are potassium chromate, sodium sulphate, chlorate and acetate, cadmium borotungstate, potassium aluminium sulphate, plumbic nitrate. These are all highly oxygenated salts.

III. Salts which, when added to water in percentages from 5 to 50, yield electrolytes which, if frozen, have immensely greater dielectric constants than pure ice at the temperature of liquid air, namely, values from 30 to 70. Such salts are sodium carbonate, borate (borax), thiosulphate and silicate, disodium hydrogen phosphate, and potassium ferrocyanide.

Acid salts were always found to have lower dielectric constants than the corresponding normal salts at the temperature of liquid air. From the downward tendency of the dielectric curves, it would seem probable that, with few exceptions, all frozen electrolytes would, if reduced to temperatures not far above the absolute zero, have their dielectric constants approximately equal, and reduce to a value not far from 2 or 3. At the same time, the electric resistivity of such frozen electrolytes would tend to become infinite, as the temperature is continuously reduced. H. C.

Dielectric Constants of Organic Substances and Electrolytes at very Low Temperatures. By James Dewar and John A. Fleming (*Proc. Roy. Soc.*, 1897, **62**, 250—266).—Several of the authors' previous determinations (this vol., ii, 8 and 9) have been repeated, using Nernst's method for the measurement of dielectric constants, and a frequency of alternation of about 350 in place of 120. For organic substances such as ethylic alcohol, amylic alcohol, ethylic ether, and glycerol, practically the same dielectric values were obtained at the low temperature as in the previous set of observations. On the other hand, for certain other substances such as frozen dilute hydroxides of potassium and rubidium and oxide of copper suspended in ice, the dielectric value at the low temperatures is much diminished by increasing the frequency. Abegg has suggested that the high dielectric values at low temperatures are due to polarisation of the electrodes of the condenser, but the authors show that this can hardly be the case. The dielectric constant may be considered as a function of the frequency and the temperature, and represented therefore by a dielectric surface, which surface has for some substances a region of abnormal dielectric ordinate. Lowering the temperature sufficiently acts in the same manner in reducing the dielectric constant as sufficiently increasing the frequency, and both actions reduce the abnormally large dielectric values of some substances to values more approximately equal to the square of the optical refractive index of the substance. H. C.

Decomposition of Compounds by Electrical Oscillations. By Alexander de Hemptinne (*Zeit. physikal. Chem.*, 1898, **25**, 284—299). —Various organic compounds were exposed in the gaseous state, at low pressure, to the influence of electrical oscillations and the decomposition products were examined. From methylic and ethylic alcohols, mixtures of carbonic oxide, carbonic anhydride, hydrogen, and methane or ethane are obtained, and as the quantity of oxides of carbon is diminished if the decomposition occurs in the presence of phosphorus, the author considers these compounds to be due to secondary actions, the primary reaction being represented by $CH_3{\cdot}OH = CH_4 + O$; analogous decompositions occur in the cases of propylic, isopropylic, and allylic alcohols. With acetone and propaldehyde, however, the presence of phosphorus causes no diminution in the quantity of oxides of carbon ; these are hence produced in the primary decomposition, which is in each case $C_3H_6O = C_2H_6 + CO$. Acetaldehyde undergoes an analogous decomposition, but acetic and propionic acids decompose with the formation of oxygen and the unsaturated hydrocarbon. Methylic acetate and ethylic formate give the same decomposition products, and the chemical formula gives no indication, in the author's opinion, of where the strongest mechanical attraction occurs. A few liquids were also exposed to the oscillatory discharge, and glycerol, glycol, glyoxal, glyceric acid, and oxalic acid were all found to be partially decomposed. Phenol and benzoic acid yielded oxides of carbon and hydrogen, and resinous compounds, the latter, together with hydrogen and acetylene, also being formed from benzene. L. M. J.

Absolute Temperature. By K. SCHREBER (*Ann. phys. Chem.*, 1898, [ii], **64**, 163—185).—A scale of temperature is suggested on which the difference of temperature between two substances *A* and *B*, of which *A* has the higher temperature, shall be 1°, no matter on what portion of the scale this difference falls, when with the reversible transference of 1 unit of heat from *A* to *B*, a transformation of one heat unit into work is connected. In a mathematical treatment of the subject, the author discusses the theoretical and practical advantages of this method of defining temperature. H. C.

Thermal Conductivity of Nitric Peroxide. By GAETANO MAGNANINI and GIOVANNI MALAGNINI (*Gazzetta*, 1897, **27**, ii, 493—497).—The authors have determined, with the aid of a specially designed apparatus, the rate at which gases take up heat when the containing vessel is immersed in a bath at a higher temperature. Air, carbonic anhydride, oxygen, and hydrogen follow Newton's law, the expression $\frac{1}{t}\log\frac{d_1 - d_0}{d - d_0}$ being constant ; d_1 is the temperature of the high temperature bath, d_0 the temperature in the vessel containing the gas after the first minute of heating, and d the temperature of the gas at the time t. Hydrogen has a higher thermal conductivity than air, carbonic anhydride, or oxygen ; at low temperatures, nitric peroxide conducts better than hydrogen, at 70—100° worse than hydrogen but better than air, and at 150—190° air conducts better than nitric peroxide. The explanation of this is found in the thermal equation $2NO_2 = N_2O_4 + 129k$, the conductivity being increased by molecules of N_2O_4 dissociated into $2NO_2$ by the hot walls of the containing vessel, travelling into the cooler mass of gas, and giving up their heat of dissociation during the act of association. At high temperatures, when the gas is completely dissociated, it conducts less rapidly than air.

The absolute coefficient of thermal conductivity k, at high temperatures, referred to millimetres, milligrams, seconds, and centigrade degrees, can be calculated from the data now given, and Winkelmann's values for air and hydrogen as $k_{150^\circ} = 0{\cdot}0033$. W. J. P.

Boiling Points of Salts in Ethereal Solution. By ROBERT LESPIEAU (*Compt. rend.*, 1897, **125**, 1094—1096).—The boiling points of various ethereal solutions of salts were determined by Raoult's method, and the general result is to show that the molecular weight of a salt dissolved in ether cannot be determined by a single observation of the boiling point of the solution, since the values vary rapidly with the concentration. It is necessary to determine the limit towards which the values tend when the concentration is continually reduced. This limit has been calculated on the assumption that the curves obtained by taking the increase in the boiling point for abscissæ, and the ratios of this increase to the weight of salt dissolved for ordinates, are right lines. With mercuric chloride, the limit was found to be 272, and with ferric chloride, 153; zinc chloride, 138; antimony chloride, 228; uranyl nitrate, $UO_2(NO_3)_2 + 6H_2O$, 1044. In the latter case, it is clear that the water does not separate from the uranyl nitrate. It has been pointed out that the molecular weights obtained by Raoult's method may be multiples of the true molecular weight, but it does not seem to be sufficiently recognised that if a substance of molecular weight M combines with the solvent S, forming a compound of the formula $MxSy$, Raoult's method at the limit will give, not the number M, but the number xM, in which x may be either less or greater than unity. If x is taken as 2 in the case of uranyl nitrate, and as 0·5 in the case of ferric chloride, the old molecular weights would be obtained. The case of ferric chloride would seem to be settled by other evidence, but the point to which the author calls attention is, he considers, of especial importance in the cases of the solutions of metals in mercury.

C. H. B.

New Process for Determining the Molecular Weight by the Boiling Point Method. By WILLY LANDSBERGER (*Ber.*, 1898, 31, 458—473).—The liquid or solution of which the boiling point is to be determined is placed in a test-tube, the side of which is perforated near the top and the mouth closed by a stopper through which pass a thermometer and a conducting tube reaching to the bottom; this vessel is then fastened by means of a cork into a larger test-tube provided with a side tube which can be connected with a condenser. The liquid is heated by the vapour of the solvent, which is passed in through the conducting tube from a flask or small copper boiler heated by a small flame or water bath. In this way, a constant temperature is reached in 2 to 4 minutes after the commencement of the experiment, so that the determination can be very rapidly carried out. The boiling point of the pure solvent is first determined, and then the inner test-tube is emptied, the required amount of the substance weighed into it, some of the solvent added, and the vapour again passed in. The temperature is observed every one-eighth of a minute, and is taken as constant as soon as three consecutive readings agree. The apparatus is then immediately disconnected from the boiler and condenser, and the inner tube cooled, cleaned externally, and weighed, the empty tube being afterwards weighed, and the weight of the solvent then ascertained by subtraction. A complete determination can be carried out in 25 minutes, and this great saving in time and the simplicity of the apparatus constitute the most important advantages of this method over that of Beckmann. The thermometer used was graduated into

0·05°, and the results obtained agree well with those of other investigators. A. H.

Laws concerning the Molecular Volumes of Liquids. By RAFFAELE NASINI (*Gazzetta*, 1897, **27**, ii, 533—555).—The author criticises at length I. Traube's work on the molecular volumes of liquids, and considers that the method of calculation employed by the latter consists only in a method of calculating molecular volumes somewhat different from those previously used. Traube's method is not as accurate as ordinary methods of calculating, owing to the hypotheses which have to be devised and to the uncertainty of the magnitudes of the fundamental values involved. W. J. P.

Determination of the Molecular Weight of Solid Substances. By ANDREAS FOCK (*Ber.*, 1898, **31**, 506—508).—A reply to I. Traube (this vol., ii, 213). Traube is not justified in extending his method of molecular weight determination from liquid and dissolved substances to solids, and in stating that "the diminution of the co-volume when a liquid solidifies is only comprehensible on the assumption that the molecules associate." The passage from the liquid to the solid state is only continuous in the case of amorphous solids; in the case of crystalline solids, it is discontinuous, and may well be accompanied by a change of volume, apart from any association of the molecules. Moreover, the author is of opinion that Traube's method cannot be applied legitimately even to liquids. C. F. B.

Viscosity of Hydrogen as affected by Moisture. By Lord RAYLEIGH (*Proc. Roy. Soc.*, 1897, **62**, 112—116).—As Crookes states that the viscosity of hydrogen is greatly affected by moisture, experiments were carried out by the author to ascertain whether viscosity might serve as a test of purity. A comparison was made between hydrogen as it issued from the generator without any desiccation whatever, and hydrogen carefully dried by passage through a long tube packed with phosphoric anhydride, but the difference proved to be comparatively trifling. The evidence from the experiments tends to show that residual moisture is without appreciable influence on the viscosity of hydrogen. H. C.

Dissociation of Dibasic Organic Acids. II. By W. A. SMITH (*Zeit. physikal. Chem.*, 1898, **25**, 193—264. Compare this vol., ii, 155).—The dissociation constant of the acid and the hydrogen dissociation of the acid sodium salt were determined in the case of a large number of dibasic organic acids. In the case of the oxalic acid series (oxalic to sebacic acids), Noyes' law is well illustrated, namely, the dissociation constant of a dibasic acid is greater, and that of the acid salt is less, the nearer together are the two carboxyl groups. In the higher acids of this series, however, the removal further apart of the acid groups has but little effect on the dissociation of the second hydrogen and these values become constant. In the substituted malonic acids, the effect of substitution is not so clear, but if only analogous acids are compared, it is seen that the dissociation of the second hydrogen decreases when that of the first hydrogen increases;

the reverse holds for the phthalic acids, whilst in the camphoric acids also the dissociation of each hydrogen is similarly affected. The effect of all substituents except hydroxyl is to cause a decrease of the dissociation of the second hydrogen; hydroxyl causes an increase, but the effect on the dissociation of the first hydrogen differs with different acids, so that Noyes' law that both hydrogens are similarly affected is not correct. The numerical results of the determinations are given in the following table, the dissociation of the first hydrogen being given by K_1, that of the second by K_2.

Acid.	$10^6 \times K_1$.	$10^6 \times K_2$.	Acid.	$10^6 \times K_1$.	$10^6 \times K_2$
Malonic	1580·0	1·0	Mal. *αα*-Dimethylglutaric	52·0	1·6
Succinic	66·5	2·3	Fum. *αα*-Dimethyladipic	42·0	1·7
Glutaric	47·3	2·7	Mal.-*αα*-Dimethyladipic	42·0	1·7
Adipic	37·6	2·4	Methylphenylitaconic	236·0	0·62
Norm. pimelic	32·3	2·6	Itaconic	151·0	2·3
Suberic	29·9	2·5	Methylethylitaconic	150·0	0·46
Azelaic	25·3	2·7	Dimethylitaconic	140·0	0·46
Sebacic	23·8	2·6	Fumaric	930 0	18·0
αα-Trimethylenedicarboxylic	21400·0	0·12	Maleic	11700·0	0·39
Dipropylmalonic	11200·0	0·05	Mesaconic	790·0	6·8
Diethylmalonic	7400·0	0·18	Citraconic	3400·0	0·24
Methylbenzylmalonic	2660·0	0·12	Phthalic	1210·0	1·7
β-Benzoylisosuccinic	2500·0	0·47	$\Delta^{2\cdot6}$-Dihydrophthalic	165·0	1·2
Methylethylmalonic	1610·0	0·17	Δ^2-Tetrahydrophthalic	76·0	0·32
Benzylmalonic	1510·0	0·49	Hydroxyterephthalic	2500·0	21·0
Ethylmalonic	1270·0	0·54	Δ^1-Tetrahydroterephthalic	50·0	2·8
Isopropylmalonic	1270·0	0·35	*trans*-Hexahydroterephthalic	45·6	2·5
Heptylmalonic	1020·0	0·61	*cis*-Hexahydroterephthalic	29·7	3·0
Octylmalonic	950·0	0·65	*βγ*-Hydromuconic	102·0	5·3
Methylmalonic	860·0	0·76	*αβ*-Hydromuconic	175·0	7·9
αα-Tetramethylenedicarboxylic	800·0	0·30	Acetylenedicarboxylic	very	strong
Dimethylmalonic	760·0	0·31	*β*-Hydroxycamphoronic	6500·0	8·4
Tartaric	970·0	59·0	*α*-Hydroxycamphoronic	3200·0	6·5
Malic	399·0	8·3	Camphoronic	175·0	8·3
para-Ethylallylsuccinic	269·0	2·3	*i*-Camphoric	22·9	0·72
Fum. Dimethylsuccinic	191·0	1·3	*d*-Camphoric	22·9	0·72
Mal. Dimethylsuccinic	123·0	0·53	*l*-Camphoric	22·9	0·70
αβ-Pentamethylenedicarboxylic	113·0	0·37	Mesocamphoric	18·7	0·66
Propylsuccinic	88·6	1·2	*l*-Isocamphoric	17·4	0·59
lsuccinic	85·0	1·3	Citric, 1st H	820·0	
Methylsuccinic	86·0	1·6	,, 2nd H		32·0
Fum. *αα*-Dimethylglutaric	58·0	1·5	,, 3rd H		0·70

L. M. J.

Equilibrium in Systems of Three Components, where Two Liquid Phases may exist. By FRANS A. H. SCHREINEMAKERS (*Zeit. physikal. Chem.*, 1898, 25, 305—331).—In a previous paper (Abstr., 1897, ii, 483), the author considered the general case of equilibrium in the above system when only one solid phase exists, and this one of the components, and he now extends the theoretical investigation to the

case where two solid phases, both components, may be present. The various forms of equilibrium curves possible, and their physical interpretation, are fully considered with the aid of the usual equilateral diagrams. In many cases, labile portions of the curve are indicated, and hence certain transition temperatures occur; for example, where a solid phase *A*, in liquid *B*, forms two liquids, one containing a high, the other a low percentage of the component *A*. The effect of the addition of a third component on this transition temperature is investigated. Two cases occur, where the component added is more soluble in (1) the liquid with low percentage of *A*, (2) the liquid with high percentage of *A*. In the first case, the transition temperature is raised, an example occurring in the case of the equilibrium of ethylenic cyanide, water, and sodium chloride, the transition temperature of the first two components being raised by the addition of the third. In the second case, the transition temperature is lowered, as, for example, by the addition of ether to the system, ethylenic cyanide and water. This two-fold influence of foreign compounds may frequently be of considerable importance in purification by crystallisation. The two cases are also considered from the thermodynamical standpoint and the results obtained above, experimentally and from the diagrams, are so deduced.
L. M. J.

Coloration of the Ions. By Giacomo Carrara and A. Minozzi (*Gazzetta*, 1897, **27**, ii, 455—467).—The authors have examined solutions of anhydrous copper sulphate in dry methylic alcohol, and find that the absorption spectra, as recorded photographically, are the same for aqueous and methylic alcohol solutions of the same concentration. A quantitative examination of the absorption spectra shows that the absorption for the wave-lengths $\lambda = 668—650$, $640—622·5$, and $586—573·7$, in concentrated solutions, is stronger for aqueous than for methylic alcohol solutions, whilst for dilute solutions the converse is true. Of the curves obtained by plotting concentration against absorption, those for aqueous and methylic alcohol solutions cross each other, but the points at which they cut are different for the different wave-lengths.

Determinations of the electrical conductivity of methylic alcohol solutions of copper sulphate show that, at ordinary temperatures, more dissociation always exists in the alcoholic than in the aqueous solutions of the same concentration. No simple relation between the absorptive power of the solutions and the dissociation could be established.
W. J. P.

Crystalline Liquids. By Rudolf Schenck (*Zeit. physikal. Chem.*, 1898, **25**, 337—352).—Certain para-azoxy-compounds, parazoxyanisoil, for example, melt to a turbid liquid, which, at a higher temperature, becomes clear, and it was shown by Lehmann that, although this turbid liquid consists of liquid drops, yet it exhibits double refraction and behaves optically like a crystalline compound. When the temperature is raised, and the liquid becomes clear, these optical properties are lost; this temperature may hence be regarded as the transition temperature of the two liquids, and the author endeavoured to determine the molecular weight of the two liquids in the cases of parazoxyanisoil, parazoxyphenetoil, and cholesterylic benzoate. By the dilatometric method, the transition temperatures for these compounds were found to be respectively 134°, 165·2°, and 178°, the last compound exhibiting but a very small density change. The molecular surface energy was determined by Ramsay and Shields' method, but only in the case of the cholesterylic benzoate was any indication obtained of a difference in the molecular weights of the two liquids. The molecular lowering of the transition temperature in the case of parazoxyanisoil was 750·2, from which, by the expression $0{\cdot}02T^2/u$, the heat of transition is calculated as 4·42 cal. Mixtures of the compounds gave a transition temperature agreeing satisfactorily with that calculated by the mixture rule. The effect of pressure was calculated for parazoxyanisoil by the expression $dt/dp = T(v^1 - v)/u$; to raise the transition point one degree requires about 13 atmospheres pressure. L. M. J.

Action exerted by certain Metals and other Substances on a Photographic Plate. By WILLIAM J. RUSSELL (*Proc. Roy. Soc.*, 1897, **61**, 424—433).—Becquerel (Abstr., 1896, ii, 406) has shown that uranium and some of its salts act on a photographic plate, the action being rendered evident by the ordinary process of development. The author records some experiments which have been made to determine whether the uranium compounds lose their peculiar activity on being kept in the dark. No marked difference could be detected between samples kept in the light and those preserved in total darkness. In carrying out these experiments, and using a card painted with the yellow oxide of uranium, perforated zinc was used as a screen to show the activity of the uranium compound by the density of the picture of the pattern formed, but, in place of obtaining in all instances a negative of the perforated zinc, the reverse took place, and the greatest amount of action occurred underneath the zinc. From this it appeared that zinc itself must be able to effect a change of the same kind as the uranium, at all events, to act on a photographic plate, and further experiment with zinc alone proved this to be the case. Colson (Abstr., 1896, ii, 601) has also described this action of zinc, and found that similar results can be obtained with cadmium and magnesium; he ascribes the action to vapour given off by these metals.

A large number of experiments were made with zinc under different conditions. The zinc must be clean and bright, as, in its ordinary condition, after exposure to the air, it ceases to be active. The salts also have no power of acting in this way. A polished piece of zinc laid on a highly sensitive photographic plate will, under certain conditions, even in 4 or 5 hours, so act on it that, on development, a complete picture of the zinc is produced, showing the scratches or any ruled lines or faint pattern drawn on it, or, if flaws in the metal exist, they are clearly seen.

Absolute contact of metal and plate is not necessary. If screens of different thicknesses of any inactive substance be interposed between plate and metal, thus preventing contact, the action still occurs; if the screen be very thin, a picture of the zinc surface is still obtained, but if thicker, only a dark, cloudy patch is formed. If a thick piece of glass tubing an inch long be placed on a photographic plate, and the upper end covered with a piece of polished zinc, in a week to a fortnight distinct action will be found to have taken place below the zinc. The action is not transmitted through glass, even of the thinnest kind, but takes place readily through celluloid, sheet gelatin, gutta-percha tissue, collodion, vegetable and real parchment, goldbeater's skin, tracing paper, and, no doubt, many other substances. Certain writing papers are quite opaque to the action; with others, pictures of the structure and the watermark are easily obtained. A mere difference of colour does not appear to alter the absorptive power of a medium; at least, this is the case with gelatin.

In addition to cadmium and magnesium, many other metals and also certain alloys produce effects similar to that produced by zinc. The following is a rough list of active metallic substances approximately in the order of their activity:—mercury, magnesium, cadmium, zinc, nickel, aluminium, pewter, fusible metal, lead, bismuth, tin, cobalt, antimony. Mercury is at ordinary temperatures the most active metal, but the other metals do not follow in the order of their fusibility or exactly according to any obvious physical property, but most nearly according to their position in the electrical series. The action of mercury does not take place as readily through gelatin, but more readily through gutta-percha than is the case with zinc. Iron, gold, and platinum are not active, and copper only very slightly. These results are founded on experiments in which the exposure lasted one week; with longer exposure, other metals will probably produce some action.

Aqueous vapour is not apparently an active agent in producing these reactions. In an atmosphere of hydrogen, the action takes place as it does in air. Carbonic anhydride, under ordinary conditions, does produce an effect, but this probably arises from its action on the zinc plate. Alteration of temperature produces very marked effects, as in all cases increase of temperature causes increased action. Like glass, selenite, gum arabic and paraffin are impervious to the action. The behaviour of certain salts in the dry state was tried by soaking unglazed paper in different solutions, drying it, and then placing it, either with or without a screen, between the zinc and the photographic plate. Solutions of alum, potassium chromate, zinc sulphate, and quinine sulphate were found to render the paper quite opaque to the action of the zinc.

Some singular developments of this subject have arisen from experiments made while examining the metals. A piece of polished zinc was coated with copal varnish with the object of ascertaining whether the action would take place through this medium. The photographic plate, notwithstanding the varnish was strongly acted on, indeed the pictures were darker than those given by the zinc alone, and on trying the copal on plain glass instead of on zinc, it proved that effects apparently similar to those obtained with zinc were produced. Substances which are transparent or opaque to the action of the metals seem to act in the same way towards copal. Glass is perfectly impervious to its action, but celluloid, gutta-percha tissue, and gelatin it permeates more readily than zinc does. It is rather more active than zinc. The activity of the copal varies considerably under different conditions. The fused gum is not so active as when picture varnish is used. Heating it in a water bath for a considerable length of time certainly deprives it of some of its activity; but this can be revived by wetting it with ether and allowing it to dry again at ordinary temperatures. As with zinc, increase of temperature increases its activity to a great extent.

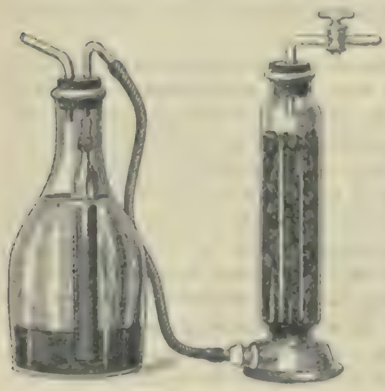
Many other substances of the same nature as copal act in the same way. This has been proved to be the case with Damar and with Canada balsam, but copal seems to be the best representative of the class. Certain gums, such as gum arabic, gum senegal, have not the property of acting in this way. There are, however, a large number of substances which have the power of acting in a manner similar to the copal; one of these is wood, and it possesses a very considerable amount of activity. Any ordinary smooth piece of wood laid on a photographic plate will act like zinc in impressing its picture on the plate. Substances such as straw, hay, bamboo, oiled silk, and no doubt many others, act in the same way. If wood, however, is painted with melted paraffin it is no longer active. Ordinary charcoal also depicts itself on a photographic plate, but if it be heated for some hours in a covered crucible it loses this property. An ordinary piece of wood, if it be charred on one side by heating it with a Bunsen lamp, becomes remarkably active. The action passes readily through different media, such as gelatin, tracing paper and vegetable parchment, and the structure of the charcoal is shown, when the action has taken place, even through a sheet of vegetable parchment. Coal and coke, sulphur, sugar, on the other hand, exert no action of this kind. Printers' ink in most cases is not capable of acting, like copal, on a photographic plate, but there are many cases in which it is a remarkably active substance. Specially so is the ink used in printing many of the newspapers. Samples of strawboard from different sources have been tried, and all found to be active, and different substances of a like nature have been tried, such as brown papers, some of which are active, but none more so than common strawboard. Writing paper and white cardboard have not this power of acting on a photographic plate.

The action of the vapour from a few liquids on a sensitive plate has been tried. The plate was placed about half an inch above the liquid, and a screen, with holes cut in it, was fastened against the plate. Methylated spirit acted slightly on the plate; pure alcohol and ether had no action, but turpentine and oil of cloves produced a slight amount of action.

The supposition that all these active substances, the metals as well as organic compounds, give off a vapour capable of acting on a photographic plate, naturally suggests itself, and that copal does give off a vapour which directly or indirectly is active there can be no doubt. At the same time, it is difficult to suppose that this can be the case throughout, and further experiments, it is hoped, may lead to explanations not now evident.

It is only the most sensitive photographic plates which, without extremely long exposures, give the results described. H. C.

Self-regulating Gas-generating Apparatus. By W. W. ANDREWS (*Chem. Zeit.*, 1897, 21, 666—667).—The apparatus consists of two parts, a reservoir filled, say, with acid, and a generator filled with the requisite material.



The former has the appearance of an ordinary wash-bottle, the longer tube of which penetrates but a short distance into the acid, and is sealed into a wider tube, open at the bottom and slightly perforated near the top; this reaches to the bottom of the acid.

The generator is merely an ordinary calcium chloride tower, connected by means of a long india-rubber tube with the reservoir. To set the apparatus going, the tap of the tower is opened, and a little acid is blown in from the reservoir; this starts the syphon, and more acid enters in consequence. When the tap is closed, the acid is forced back into the reservoir, and being now higher in specific gravity, it sinks to the bottom. On reopening the tap, the syphon again acts, and fresh acid enters the tower. For acetylene, another kind of generating bottle, made of thin glass so as to withstand heat, is recommended. L. DE K.

Inorganic Chemistry.

Preparation of Chemically Pure Hydrogen Sulphide for Laboratory Purposes. By JOSEF R. MICHLER (*Chem. Zeit.*, 1897, 21, 659).—The author recommends using a solution of calcium sulphide to obtain a hydrogen sulphide absolutely free from arsenic. A solution of sp. gr. = 1·16 is capable of yielding 110 times its volume of the gas when treated with hydrochloric acid. L. DE K.

[Chemical and Physical Properties of very Concentrated Nitric Acid.] By VICTOR H. VELEY and J. J. MANLEY (*Proc. Roy. Soc.*, 1897, 62, 224—225).—See this vol., ii, 277.

Densities of Carbonic Oxide, Carbonic Anhydride, and Nitrous Oxide. By Lord RAYLEIGH (*Proc. Roy. Soc.*, 1897, 62, 204—209).—The observations were carried out by the method and with the apparatus described in a former paper (Abstr., 1893, ii, 514). Carbonic oxide was prepared from potassium ferrocyanide, from oxalic acid, and from sodium formate. The density found was 27·9989 ($O = 32$), and if equal volumes may be taken as accurately representative of CO and of O_2, the atomic weight of carbon will be 11·9989

(O = 16). Carbonic anhydride from marble and hydrochloric acid gave the weight 3·6349, and nitrous oxide prepared from ammonium nitrate, or obtained from the commercial liquefied gas, gave 3·6359, corresponding with 2·6276 for oxygen.

The following summary gives the densities of the various gases relatively to air, all obtained by the same apparatus. The last figure is of little significance.

Air, free from H_2O and CO_2	1·00000	Argon	1·37752
Oxygen	1·10535	Carbonic oxide	0·96716
Nitrogen and argon (atmospheric)	0·97209	Carbonic anhydride	1·52909
Nitrogen	0·96737	Nitrous oxide	1·52951

The value obtained for hydrogen on the same scale was 0·06960; but the researches of Leduc and Morley appear to show that this number is a little too high. H. C.

Formation of Metallic Sodium from Sodium Peroxide. By Heinrich Bamberger (*Ber.*, 1898, **31**, 451).—Metallic sodium is readily formed when a mixture of sodium peroxide with charcoal, coke, or graphite is heated at 300—400° in a covered crucible. The reaction, which is a very violent one, must only be carried out with small quantities, and can be used as a lecture experiment, the sodium being found after the experiment on the cover and the cool upper portion of the sides of the crucible. The reduction can also be effected by means of calcium carbide, the reaction then being even more violent than when carbon is used. A. H.

Coloured Haloid Salts of the Alkali Metals. By Eilhard Wiedemann and Gerhard C. Schmidt (*Ann. Phys. Chem.*, 1898, [ii], **64**, 78—91).—The authors have investigated the colour changes taking place in the haloid salts of the alkali metals under the influence of the cathode discharge, already noticed by Goldstein (Abstr., 1895, ii, 150) and others. They find that the coloured product always has an alkaline reaction, and that in physical and chemical properties it is identical with the substance obtained by treatment of the haloid salt with the alkali metal. The colour change must, therefore, be regarded as due to the formation of a subchloride, or solution of the free metal in the haloid salt. H. C.

Baker's Research on the Non-combination of Dry Hydrogen Chloride and Ammonia; Vapour Density of Dry Ammonium Chloride. By S. Gutmann (*Annalen*, 1898, **299**, 267—286).—The author has repeated Baker's experiments (Trans., 1894, **65**, 611) relative to the effect exerted by water on the combination of hydrogen chloride with ammonia, but the results of his investigation do not confirm those of Baker.

In the first place, he shows that dry hydrogen chloride is absorbed by phosphoric anhydride; the drier the gas, the more slowly does absorption proceed, advancing more rapidly with time, then finally becoming retarded. It is also found that dry ammonia is absorbed by phosphoric anhydride.

The author's experiments indicate that complete desiccation of hydrogen chloride and ammonia is powerless to prevent combination, although the action is much retarded, and is rendered less energetic.

Determination of the vapour density of carefully dried ammonium chloride gave results concordant with complete dissociation (compare, however, Baker, Trans., 1898, 422). M. O. F.

Ammonium Peroxide. By PETR. G. MELIKOFF and L. PISSARJEWSKY (*Ber.*, 1898, **31**, 446—449. Compare this vol., ii, 161, 219).—When an ethereal solution of ammonia and hydrogen peroxide is cooled to −40°, a granular, crystalline mass is deposited which has the composition $(NH_4)_2O_2 + H_2O_2$, and readily decomposes at −40° into ammonia and hydrogen peroxide; the crystals are isotropic and appear to be cubes. At the ordinary temperature, the compound decomposes into ammonia and oxygen according to the equation $(NH_4)_2O_2 + H_2O_2 = 2NH_4 \cdot OH + O_2$, a trace of ammonium nitrite being simultaneously formed; in an aqueous solution, a similar decomposition occurs, the amount of nitrite formed increasing with the degree of dilution and with the temperature.

The evolution of oxygen which takes place when ammonia and hydrogen peroxide are brought together in solution, is therefore due to a reaction between ammonium peroxide and hydrogen peroxide, precisely similar to that which occurs when sodium peroxide and hydrogen peroxide are mixed. A. H.

Duration of the Phosphorescence of Strontium Sulphide. By JOSÉ R. MOURELO (*Compt. rend.*, 1897, **125**, 1098—1100).—When the different modifications of strontium sulphide (Abstr., 1897, ii, 450 and 469) are exposed to light under similar conditions, the intensity of the phosphorescence increases in the following order. (A) Prepared by the reduction of the sulphate by charcoal; (B) by the action of sulphur on the carbonate; (C) by the action of hydrogen sulphide on the oxide; (D) by Verneuil's method for preparing calcium sulphide, and (E) the author's modification of Verneuil's method. The length of time during which the sulphides retain their phosphorescence increases in the same order; A and B ceased to phosphoresce after 3 hours, whilst E was still phosphorescent, although feebly, after 12 hours. When the time of exposure of the sulphide to light is increased, the colour and intensity of the phosphorescence is not affected, but its duration is materially prolonged.

The minimum time required to excite phosphorescence is least in the case of E and greatest in the case of A; it follows the inverse order of the intensity and duration. With E, a second's exposure to diffused light is sufficient to set up distinct phosphorescence.

Temperature, up to 50°, has no appreciable influence on the intensity of the phosphorescence, but prolonged exposure to direct sunlight slightly reduces the intensity. On the other hand, insolation markedly reduces the minimum exposure required to excite phosphorescence, but this effect gradually disappears and the sulphide returns to its original condition as regards sensitiveness. C. H. B.

Alloys of Beryllium and Copper. By PAUL LEBEAU (*Compt. rend.*, 1897, **125**, 1172—1174).—Metallic beryllium cannot be obtained by the action of the electric arc on a mixture of the oxide and carbon or of the oxide and the carbide, most probably owing to the great readiness with which beryllium and carbon combine at high temperatures. Alloys of beryllium with other metals can, however, readily be prepared by reducing beryllium oxide in presence of a metal or a metallic oxide. When a very intimate mixture of copper and beryllium oxides (such as is obtained by the action of heat on the mixture of nitrates obtained by dissolving the two oxides, in any desired proportions, in nitric acid) is heated with carbon for five minutes with an arc from a current of 900 ampères and 45 volts, the product is red, brittle, and non-homogeneous; when liquated, it yields the pure beryllium-copper alloy, and leaves a crystalline mass of a double beryllium copper oxide.

The alloys that contain 10 per cent. of beryllium are pale yellow, almost white; those with 5 per cent. are yellower, can be filed and polished readily, and are malleable when hot or cold. They do not alter in the air, but tarnish slightly in presence of hydrogen sulphide, and are readily dissolved by nitric acid. From these alloys, others containing a definite, but lower, proportion of beryllium can readily be prepared by melting them with the necessary proportion of copper. Even so low a proportion of beryllium as 0·5 per cent. distinctly alters the appearance of the copper, and makes it very sonorous. An alloy containing 1·32 per cent. of beryllium is golden yellow, highly sonorous, and can readily be filed and forged.

Alloys of beryllium with the common metals and with chromium, molybdenum, tungsten, and some other refractory metals have been prepared and will be described later. C. H. B.

Cadmium Compounds. By Francesco Canzoneri. (*Gazzetta*, 1897, **27**, ii, 486—492).—On heating cadmium with cadmium chloride, in the hope of obtaining a cadmium subchloride, the author obtained a small proportion of a grey powder the composition of which depends on the composition of the mixture of cadmium and cadmium chloride used. If cadmium chloride is in excess, the grey powder has practically the composition $2CdO,CdCl_2$; a similar product is formed, with development of heat, as a heavy, white powder on fusing a mixture of cadmium oxide and chloride in the requisite proportion. If cadmium is in excess, the product contains more cadmium than is required for the composition $2CdO,CdCl_2$. W. J. P.

Microchemical Examination of Alloys. By John E. Stead (*J. Soc. Chem. Ind.*, 1897, **16**, 200—208; 506—509).—Lead-antimony alloys containing less than 12·5 per cent. of antimony appear to be perfectly homogeneous after solidification, but with a higher percentage of antimony, crystals of that metal separate throughout the mass, and rise to the surface, leaving the eutectic alloy of the composition Pb_4Sb, which has a solidifiying point of 247°, and sp. gr. = 10·48. This solidifies in spherulites, radiating from neuclei, and during solidification splits up into laminæ of its constituent metals. The solidified eutectic alloy of lead and tin consists of similar masses of spherulites. From alloys of tin and antimony, cubical crystals of the composition SnSb separate, but the compound seems only to form in presence of a considerable excess of tin.

The papers contain much valuable information respecting other alloys, and are illustrated with microphotographs of the appearance of polished and etched surfaces. M. J. S.

Cerium. By O. Boudouard. *Compt. rend.*, 1897, **125**, 1096—1097.—A reply to Wyrouboff and Verneuil. (This vol., ii, 222).

Atomic Weight of Cerium. By Grégoire N. Wyrouboff and Auguste V. L. Verneuil. (*Compt. rend.*, 1897, **125**, 1180—1181).—A continuation of the discussion with Boudouard (preceding abstract). In the authors' experiments, the maximum atomic weight obtained was 92·85 and the minimum 92·49. They point out that, although pure cerium oxide is white, the mere absence of colour is not of itself any guarantee of complete purity. C. H. B.

Impurities of Aluminium and its Alloys. By Ed. Defacqz (*Compt. rend.*, 1897, **125**, 1174—1177).—When aluminium is dissolved in dilute hydrochloric acid (1 : 5) the residue is impure silicon, containing silica and aluminium, and ferric oxides, with traces of copper. An alloy of aluminium with 3 per cent. of copper, when dissolved in dilute aqua regia, also yields impure silicon containing 5 per cent. or more of copper oxide. The same alloy when dissolved in hydrochloric acid (1 : 10), yields a non-homogeneous residue of copper mixed with silicon, iron, and aluminium. All these residues oxidise very readily, even on the filter. It is noteworthy that, when the aluminium and its alloys are dissolved in dilute acids, the impurities divide themselves unequally between the solution and the residue. C. H. B.

Chromous Sodium Carbonate. By Georges Baugé. (*Compt. rend.*, 1897, **125**, 1177—1180).—When well washed and moist chromous acetate is mixed with a solution of sodium carbonate, it first dissolves and after a time a reddish-brown compound separates; this is washed with water, and afterwards with alcohol of 98°, all the operations being conducted in an atmosphere of carbonic anhydride. After drying in a current of carbonic anhydride, it has the composition $CrNa_2(CO_3)_2 + 10H_2O$, and forms microscopic, tabular lozenge-shaped crystals which lose water in a vacuum at the ordinary temperature or at 100°. It is very soluble in cold water, but the solubility gradually diminishes, probably in consequence of polymerisation. It is a powerful reducing agent, and decomposes water at a little below 100° with liberation of hydrogen and formation of a compound that will be described later. When exposed to dry air, it effloresces, and is afterwards converted into a mixture of sodium carbonate and chromic hydroxide; in moist air, it oxidises rapidly with development of heat. Chlorine converts it into chromic oxide with liberation of carbonic anhydride; hydrogen and hydrogen sulphide have no action on it in the cold, and when heated at 100° in a current of these gases, it yields the monhydrate. Dilute hydrochloric and sulphuric acids dissolve the salt, forming blue solutions.

The monhydrate, $CrNa_2(CO_3)_2 + H_2O$, is prepared from the decahydrate by the action of a current of a dry inert gas at 100°. It is a yellow powder which becomes brown when heated in a vacuum or a current of hydrogen, but regains its yellow colour on cooling. At 300°, it decomposes into sodium carbonate and chromic oxide. When heated in air, it is converted into sodium chromate; when heated in chlorine, it yields chromyl dichloride and chromic oxide; in hydrogen sulphide at about 240°, it yields the red, crystalline sulphide described by Moissan. Its other properties are practically identical with those of the decahydrate. C. H. B.

Alkali Salts of Perchromic Acid. By O. Fritz Wiede (*Ber.*, 1898, **31**, 516—524. Compare this vol., ii, 28).—By the action of ammonia under certain conditions on an ethereal solution of perchromic acid, there is formed a substance of the formula $NH_4CrO_5 + H_2O_2$; this is a violet-black, crystalline powder, and may be preserved for several days in a cold situation if protected from moisture. When kept for some time, it becomes superficially yellow, and when exposed to air passes completely into ammonium dichromate within 24 hours. The solution in ice-cold water is violet-brown, and neutral to test paper; the concentrated solution rapidly decomposes, yielding oxygen and ammonium dichromate. Ammonia converts the substance into the compound of chromium tetroxide and ammonia (*loc. cit.*); dilute sulphuric acid gives rise to an indigo-blue solution. Barium chloride and lead acetate give violet-brown precipitates, which, after liberating gas, pass into the yellow chromate; silver nitrate yields a brownish-violet turbidity, which immediately changes into the reddish-brown silver chromate. Ferric chloride develops a grass-green coloration, whilst ferrous sulphate liberates gas and forms a yellow solution; potassium permanganate forms a blood-red solution, which yields oxygen and manganese dioxide when acidified.

By means of alcoholic potash at $-5°$, the corresponding potassium compound, having the formula $KCrO_5 + H_2O_2$, has been obtained as a violet, indefinitely crystalline powder; it is highly explosive, and begins to decompose in the process of desiccation. In aqueous solution, it behaves like the ammonium compound.

The author regards the hydrogen peroxide in the foregoing compounds as hydrogen peroxide of crystallisation. In an ethereal solution of perchromic acid, the latter is not in combination with hydrogen peroxide. M. O. F.

Rare Earths. By Ludwig Haber (*Monatsh.*, 1897, 18, 687—699).—*Thorium chromate*, $Th(CrO_4)_2 + 3H_2O$, is precipitated as an orange-yellow, crystalline powder when a solution of thorium nitrate is boiled for some time with chromic acid, or, better, with potassium or sodium dichromate; under similar conditions, cerium, lanthanum and didymium salts, however, give no precipitate, whilst zirconium forms a *basic chromate*, the composition of which varies with the mode of preparation.

When a solution of a thorium salt to which sodium acetate has been added is well boiled, a brilliantly white, crystalline precipitate of *basic thorium acetate*, $Th(OAc)_2(OH)_2 + H_2O$, is formed. Since cerium, lanthanum and didymium are not precipitated at all under the same conditions, this reaction affords an easy method of preparing thoria free from these metals; zirconium is, however, precipitated as a *basic acetate* of indefinite composition.

Whilst cerium, lanthanum, and didymium salts are precipitated by sodium formate as normal formates, the salts of thorium and zirconium give rise to crystalline, *basic formates* of varying composition.

The precipitate formed on adding tartaric acid to a solution of thorium chloride appears to have the composition, $C_4H_4O_7Th(OH)_2$, not $(C_4H_4O_6)_4Th_3(OH)_4 + 5H_2O$, as stated by Cleve (this Journal, 1875, 236). Cerium, lanthanum and didymium are not precipitated by tartaric acid, whilst zirconium gives rise to a salt of varying composition.

A *basic thorium citrate*, $C_6H_5O_7Th\cdot OH$, is formed as a white, flocculent precipitate on heating a solution of thorium chloride with citric acid.

Thorium malate, $(C_4H_4O_5)_3Th_2(OH)_2$, is a white, crystalline powder which is almost insoluble in water. W. A. D.

Mineralogical Chemistry.

Steenstrupine. By JOH. CHR. MOBERG (*Zeit. Kryst. Min.*, 1898, **29**, 386—398).—Steenstrupine, first described by Lorenzen (Abstr. 1883, 960), has only been found in the nephelite-syenite at Kangerdluarsuk in West Greenland; it has been placed by Brögger in the melanocerite group. The following new analyses have been made by Blomstrand: I, on crystalline material of sp. gr. = 3·4009, carefully separated from enclosed ægirite; II and III, on massive, and more altered material. None of these lead to simple formulæ; with the exception of the presence of beryllium and phosphoric acid, analysis I agrees with that made by Lorenzen. The black, rhombohedral crystals are tabular in habit, and the faces are somewhat rough and rounded; the axial ratio, $a : c = 1 : 1·0842$, is near to that of eudialyte, but quite different from that of melanocerite. The mineral is optically negative; thin sections show variations in the strength of the double refraction, and other signs of alteration.

	SiO_2.	Ta_2O_5, Nb_2O_5,	P_2O_5.	ThO_2.	Ce_2O_3.	La_2O_3, Di_2O_3.	Y_2O_3.	Fe_2O_3.
I.	26·57	1·21	5·81	3·03	14·40	15·90		4·55
II.	20·61	1·58	4·53	3·84	17·03	15·52	2·19	5·18
III.	21·30	1·02	4·39	4·13	18·50	16·68	1·68	4·91

	Mn_2O_3.	Al_2O_3.	BeO.	CaO.	PbO.	Na_2O.	K_2O.	H_2O.	Total.
I.	4·40	2·55		4·03	0·46	8·34	0·50	7·58	99·33
II.	5·79	0·40	1·22	4·22	1·02	2·53	—	12·73	98·39
III.	6·80	0·60	1·93	4·55	0·78	2·54	—	10·30	100·11

The mineral is decomposed by hydrochloric acid, giving a dark brown solution which evolves chlorine. Crystalline material with a pale yellow streak and sp. gr. = 3·4733, gave off chlorine corresponding with 0·184 per cent. of active oxygen; in anal. I, this gives Mn_2O_3, 1·82, and MnO, 2·32 per cent. The more altered massive material with a dark brown streak, sp. gr. = 3·1901, and SiO_2, 21·59; H_2O, 13·39 (of this 4·64 was lost at 100—110°), contained 1·48 per cent. of active oxygen, which is enough to convert all the manganese and cerium in II and III into Mn_2O_3 and CeO_2 respectively. L. J. S.

[Microcline from Bohemia]. By FRIEDRICH KATZER (*Jahrb. f. Min.*, 1898, i. Ref. 72; from *Oesterr. Zeit. Berg- u. Hüttenwesen*, 1896, **44**).—In a description of the felspar industry in Bohemia, the following analysis is given of greyish-green to green microcline, from Kloub near Protivin.

SiO_2.	Al_2O_3.	CaO.	K_2O.	Na_2O.	MgO.	Loss on ignition.	Total.
63·22	18·96	—	16·02	1·94	0·12	0·33	100·59.

L. J. S.

Alpine Cordierite-pinite. By HERMANN GEMBÖCK (*Zeit. Kryst. Min.*, 1898, **29**, 305—332).—The general term pinite includes a large number of alteration products of cordierite, felspar, nephelite, and other minerals; under the name cordierite-pinite, the author considers only those which have been derived from cordierite. Under the microscope, these are seen to consist mainly of muscovite and chlorite, with a little quartz, biotite, limonite, kyanite, epidote, and garnet. Only a portion is soluble in hydrochloric acid, the soluble portion containing aluminium and iron with a little calcium and magnesium. Material from the Alps is described; lists of crystal forms, &c., and a review of the literature are given. L. J. S.

Mineral Water from S. Omobono in the Imagna Valley. By GIACOMO CARRARA (*Gazzetta*, 1897, **27**, ii, 559—571).—The old spring of S. Omobono issues from a black, schistose rock, containing pyrites, in the Imagna valley, about 23 kilometres from Bergamo; the water, which has been considered efficaceous in cases of skin diseases, issues at a temperature never exceeding 13°, and has an odour of hydrogen sulphide. It has the sp. gr. = 1·00026 at 9·5°, and contains traces of copper, arsenic, aluminium, and phosphoric acid. The analytical results show that the water contains the constituents stated in grams per litre in the accompanying table.

Substance.	Percentage.	Substance.	Percentage.
LiCl	0·00003	$Ca(HCO_3)_2$	0·28000
NH_4Cl	0·00004	$Mg(HCO_3)_2$	0·19237
NaCl	0·00216	$Fe(HCO_3)_2$	0·00033
NaI	0·00005	SiO_2	0·01144
$BaSO_4$	0·00035	TiO_2	0·00001
$SrSO_4$	0·00707	CO_2 (free)	0·07468
K_2SO_4	0·01153	H_2S	0·00601
Na_2SO_4	0·07031	N_2 (free)	0·01488
$NaHCO_3$	0·03864	Organic matter	0·03117

The bacteriological examination shows the water to be of a high degree of purity; plate cultivations gave colonies of *Bacillus fluorescens liquefacens*, *Tamnidium elegans*, *Mucor mucedo*, and white water bacilli.

W. J. P.

Physiological Chemistry.

Evolution of Gases During Pancreatic Digestion. By FERDINAND KLUG (*Pflüger's Archiv.*, 1898, 70, 329—345).—In 1874–1875 Hüfner (*J. prakt. Chem.*, 10, 1; 11, 43), and in 1881 Wassilieff (*Zeit. physiol. Chem.*, 6, 112) stated that various gases, especially carbonic anhydride, were evolved during pancreatic digestion when the activity of bacteria are excluded. Since then the opinion has, however, been generally held that the formation of such gases is due to micro-organisms. In the present research, the old statement of Hüfner is confirmed; small quantities of carbonic anhydride, and in some cases of hydrogen also, are formed when bacterial action is excluded by disinfectants like thymol. It, however, only takes place when fat is the substance acted on; it does not occur with glycerol, so the gases are considered to originate from the decomposition of the fatty acid radicles.

W. D. H.

Absorption in the Small Intestine. By RUDOLF HÖBER (*Pflüger's Archiv.*, 1898, 70, 624—642).—Hypertonic, isotonic, and hypotonic solutions of salt in blood-serum are absorbed in the small intestine. The hyper- and hypo-tonic solutions become, in the course of absorption, isotonic. Isotonic solutions of different salts are absorbed at different rates; dealing with solutions so dilute that the salts are almost completely dissociated electrolytically, the difference in their behaviour depends on the properties of their ions. Of the kation ions, K, Na, and Li are almost equally quickly absorbed, NH_4 and urea more quickly, Ca more slowly, and Mg slowest of all. Ba, on account of its injurious action on the intestine, could not be observed. Of the anion ions, Cl is the most rapidly absorbed, then follow, in the order named, Br, I, NO_3, SO_4. From the behaviour of the NH_4 and urea, the conclusion is drawn that the cells of the intestine in their permeability resemble blood-corpuscles and plant cells. From the behaviour of Mg and SO_4, the use of sulphates, and especially of magnesium sulphate, as purgatives becomes intelligible.

W. D. H.

Action of Salts on Blood Corpuscles. By SVEN G. HEDIN (*Pflüger's Archiv.*, 1898, 70, 525—543).—Ammonium sulphate, phosphate, tartrate, and succinate, when added to blood in small quantities (0·05 gram-molecule per litre), divide themselves equally between corpuscles and plasma, whilst larger quantities (0·1) enter partly into the corpuscles, but remain principally in the plasma. The fraction which remains in the plasma increases with the amount of salt added up to 0·3 gram, and in those concentrations, where there is excess of salt in the plasma, the volume of the corpuscles diminishes.

Ammonium chloride, bromide, nitrate, thiocyanate, oxalate, ferrocyanide, ferricyanide, lactate, and ethylsulphonate distribute themselves equally in plasma and corpuscles at all concentrations.

The corresponding salts of trimethylamine, ethylamine, and, probably, of other nitrogenous bases, may be divided into the same two groups, corresponding with those of ammonium just described.

W. D. H.

Acids obtained by the Hydrolysis of the Fat of the Dog-fish. By Eugen Ljubarsky (*J. pr. Chem.*, 1898, [ii], **57**, 19—27).—On hydrolysing the fat of the Caspian dog-fish, no volatile acids were obtained, but a mixture of 17 per cent. of palmitic acid with 83 per cent. of liquid unsaturated acids. The latter portion, on oxidation with alkaline potassium permanganate, gave rise to a mixture of dihydroxystearic and dihydroxypalmitic acids, and thus consisted of a mixture of oleic acid and physetoleic acid, the latter being present in the greater proportion.

W. A. D.

Effect of Feeding with Beet and Dried and Sour Diffusion-chips on Milk Production. By Oscar Kellner and G. Andrä (*Landw. Versuchs.-Stat.*, 1898, **49**, 401—418).—Twenty-four cows were fed during four periods of 20 days on a ration of grass, oat-straw, bran, cotton meal, and earth-nut meal, with the addition of (1 and 4) roots, 50 kilos.; (2) dry diffusion-chips, 8 kilos.; (3) sour chips, 78 kilos. per 1000 lbs. live weight. The results of the experiments show that the replacement of 27·5 kilos. of roots by 4·4 kilos. of dried chips increased the yield of milk by 0·953 kilo., whilst the replacement by 41·8 kilos. of sour chips increased the yield by 1·721 kilos. per cow of 550 kilos. live weight. The weight of the cows was, on the whole, greatest during the feeding with diffusion-chips. The composition of the milk was not essentially altered.

N. H. J. M.

Yield and Composition of Sow's Milk. By William A. Henry and Fritz W. A. Woll (*Ann. Rep. Agr. Exper. Stat. Univ., Wisconsin*, 1897, **14**, 10—19).—The amount of milk yielded by several sows was ascertained by keeping the pigs by themselves and placing them with the sows at suitable intervals, weighing them before and after feeding. The weighing was continued for 3 days in each case, and the experiment was repeated at intervals of two weeks. During the period between farrowing and weaning, the average daily yields of the four sows were 5·8, 4·1, 5·4, and 5·5 lbs.

Analyses of seven samples of sow's milk gave the following percentage results.

	Water.	Fat.	Casein and albumin.	Milk-sugar.	Solids not fat.	Ash.
Average......	80·96	7·06	6·20	4·75	11·99	1·07
Lowest	79·5	3·9	5·3	3·1	10·8	0·8
Highest	82·9	9·5	7·3	6·0	13·2	1·3

Sp. gr. (average of 5 samples) = 1·0389.

When compared with the results given by König, the greatest difference is seen to be in the amount of fat and sugar (compare also Rohde, Schweinezucht, 1892, 256), but the results (for fat) correspond with those obtained by Petersen and Oetken, and König's and Rohde's figures are certainly too low, and the conclusions based on them entirely wrong. The average amount of fat (including all the available results mentioned, 64 samples) is 6·74 per cent.; a sow giving 5 lbs. of milk would therefore yield about 0·34 lb. of fat a day, a considerable amount for an animal only about one-third the weight of an average cow. N. H. J. M.

Iodothyrin and Atropine: Sodium Iodide and Muscarine. By E. von Cyon (*Pflüger's Archiv*, 1898, 70, 511—512; 634—644).—If a rabbit is atropinised so that stimulation of its vagus produces no inhibition of the heart, the administration of iodothyrin neutralises momentarily this effect. This action of iodothyrin on the heart nerves confirms the previous opinion expressed by the author on the importance of the thyroid in relation to the heart.

Sodium iodide is antagonistic to iodothyrin; the question arises, is it also antagonistic to muscarine which has a stimulating action on the vagus endings? The answer is, yes. The experiments were made on rabbits. If sodium iodide is injected intravenously, it prevents the subsequent action of muscarine, and muscarine prevents the paralysing action of sodium iodide on these nerve-endings from taking place.

W. D. H.

Formation of Fat during Phosphorus Poisoning.—By Osvaldo Polimanti (*Pflüger's Archiv.*, 1898, 70, 349—365).—This investigation was undertaken with a view to the elucidation of the much debated question whether fat may originate in the organism from proteid; the result gives an answer to this question in the affirmative. The central nervous system has no part in the changes produced by poisoning with phosphorus. The frogs used were free from glycogen. Not only fat, but also water, increases in the organs under these circumstances. W. D. H.

Chemistry of Vegetable Physiology and Agriculture.

Alcoholic Fermentation without Yeast Cells. By Eduard Schunck (*Ber.*, 1898, 31, 309. Compare this vol., ii, 127).—In 1854, the author showed that erythrozyme, the madder ferment, is capable of producing alcoholic fermentation of a sugar solution; a mixture of hydrogen and carbonic anhydride is set free, and a small quantity of succinic acid produced. M. O. F.

Formation of Nitrates. By Albert Stutzer and R. Hartleb (*Chem. Centr.*, 1897, i, 330; from *Centr. Bakt. Par.*, 1896, 2, ii, 701).—A mould fungus which forms a branched mycelium and macro- and micro-spores was found to take part in nitrification. Its action varies with the degree of development, and the nature of the nutritive solution and the presence or absence of air are of importance. Under certain conditions, the fungus lives on organic nitrogen and induces nitrification; under other conditions, nitrites and nitrates respectively are produced. N. H. J. M.

The Nitric Organism. By Albert Stutzer and R. Hartleb (*Chem. Centr.*, 1897, i, 554—555, and 1243—1244; from *Centr. Bakt. Par.*, 1897, 3, i, 6—9, 54—57, and ii, 161—177).—When the nitric organism has been growing in a liquid culture-medium for some time, and a considerable proportion of nitrite has been converted into nitrate, as Winogradsky has pointed out, the mycelium of a mould-fungus appears on the surface of the liquid. This fungus appears to be a modification of the original nitric organism, and is formed when air, free from carbonic anhydride, is passed through a test-tube containing a pure culture of the organism in a solution of sodium nitrite containing glycerol. The morphological properties of the nitric organism are, on the other hand, not changed when it is cultivated in a solution of nitrite through which atmospheric carbonic anhydride is passed; in the latter case, therefore, no mould-fungus is formed.

The authors describe the morphology of the fungus. It is best cultivated at 20—30° on agar-agar plates, with a substratum containing asparagine, peptone, sodium nitrite, sodium nitrate, urea, and ammonium sulphate. Special attention is directed to the white incrustation (*Kreideweisse Auflagerung*) that is formed by the development into hyphæ of the gonidia after they become detached from the sterigma. The hyphæ produced are not fertile, but break up into short rods, which produce spores. Under very favourable conditions, the "incrustation hyphæ" can be converted into the fungus from which they originated; under unfavourable circumstances, they give rise to a modification which cannot be distinguished from *Cladothrix*.

W. A. D.

Reduction of Nitrates by Bacteria, and consequent Loss of Nitrogen. By Ellen H. Richards and G. W. Rolfs (*Chem. Centr.*, 1897, i, 424—425; from *Tech. quart.*, 9, 40—59, and *Centr. Bakt. Par.*, 2, ii, 709—710).—In presence of decomposable, non-sterilised organic matter, and in absence of sufficient dissolved oxygen for the growth of the bacteria, the oxygen of nitrates is utilised by the bacteria, and the nitrates reduced to nitrites or to nitrogen. The reduction of nitrates in irrigated soil may be considerable, and to avoid it, water should only be allowed to flow over the land in thin layers, so as not to prevent aëration.

Some ferments seem, in spite of aëration, to assimilate most readily the oxygen of nitrogenous compounds, and loss of nitrogen cannot be avoided when solutions containing certain organic compounds are applied to land containing nitrates. N. H. J. M.

Euglena Sanguinea. By Fr. Kutscher (*Zeit. physiol. Chem.*, 1898, 24, 360—363).—The deep brown-red pigment of this flagellate can be dissolved out with alcohol, and on evaporating the alcohol, octahedral crystals are obtained; they sinter at 103° and melt at 105°, are coloured blue by 50 per cent. sulphuric acid, and green by 50 per cent. nitric acid. An ethereal solution gives one absorption band in the green. The pigment is not the same as bacterio-purpurin, which gives three absorption bands. The organism also contains paramylum granules. W. D. H.

Effect of Chemical Agents and of Light on Germination. By A. J. J. Vandevelde (*Chem. Centr.*, 1897, i, 822—823; from *Bot. Centr.*, 69, 237—342).—In order to ascertain the effect of chemical agents on germination, seeds of *Pisum sativum* were kept for 24 hours in different solutions. Pure water did not alter the power of germinating, but the energy of germination was not inconsiderably accelerated. In presence of dissolved substances, the power and the energy of germination decreased as the strength of the solutions increased, up to a certain point of concentration; beyond this point, the effect of the solution diminished the nearer its strength approached saturation. In saturated solutions, the seeds did not swell. This diminished effect in strong solutions is attributed to the lessened power of diffusion.

The nitrates of potassium, sodium, ammonium, calcium, barium, and strontium are more injurious than the corresponding chlorides, and the sulphates of potassium, sodium, and ammonium less injurious than the chlorides and nitrates.

With potassium and sodium salts, the power and the energy of germination are similarly affected when the metal is the same.

Contrary to what would be expected, judging by their effect on the animal organism, barium and strontium salts are less injurious to germination than calcium salts. Potassium chlorate is only slightly injurious during the first stages, and the perchlorate is still less so; but potassium chromate and dichromate, and copper and iron sulphates are extremely injurious.

With regard to the effect of light, experiments made with a variety of seeds showed that germination was not affected by the presence or absence of light. N. H. J. M.

Effect of Formaldehyde on Germination. By Wilhelm Kinzel (*Landw. Versuchs.-Stat.*, 1898, 49, 461—466).—The object of the investigation was to ascertain whether formaldehyde is suitable for destroying the smut of grain crops, or whether it would prove injurious to the germinating power of the grain. Rye, wheat, oats, barley, clover, and lupins were treated with 0·1, 0·2 and 0·5 per cent. formaldehyde solutions for ½, 1 and 2 hours. It was found that 0·1 per cent. formaldehyde (for 1 hour) was without injury to the seeds, whilst it almost entirely destroyed spores obtained from oats.

Dilute solutions of formaldehyde undergo less change than was supposed; 0·1 per cent. solutions, kept for 10 days, showed their full effect on spores, whilst a 40·8 per cent. solution still contained 38·4 per cent. of formaldehyde when kept for 14 months.

N. H. J. M.

Dependence of the Functions of Chlorophyll on the Chromatophores and on the Cytoplasm. By Leopold Kny (*Ber. deut. bot. Ges.*, 1897, 15, 388—403).—Whilst Boussingault (*Agronomie*, 4, 317) and Jodin (Abstr., 1886, 476) found that chlorophyll can no longer assimilate the carbon of carbonic anhydride in absence of the chromatophores, Regnard (Abstr., 1886, 254) obtained results indicating that this property of chlorophyll is independent of the vegetable cell. In Regnard's experiments, however, the blue coloration did not appear for two or three hours; and Jodin (*loc. cit.*, p. 648) and Pringsheim (*Ber. deut. bot. Ges.*, 1886, 4) have thrown doubt on the suitability of the reagent he employed. In the experiments now described, a suitable solution for qualitative purposes was prepared as follows. Hydrogen sodium sulphite (about 30 grams) was dissolved in tap water (100 c.c.), zinc dust added, the whole shaken for 5 minutes, and diluted with 5 to 10 parts of water. After being filtered, the solution is treated with rather thick milk of lime until slightly alkaline, and allowed to settle. When indigo-carmine is added to the solution until it is still just decolorised, the mixture has a yellowish tint. Jodin's statement (*loc. cit.*) that the Coupier blue preparation acquires a blue colour when exposed to sunlight, also holds good for the indigo-carmine solution, but this is overcome by heating the preparation to boiling, before exposure to sunlight, quickly closing the vessel. The solution may then be exposed to sunlight for several days without change. Experiments made with the above solution showed clearly that chlorophyll cannot decompose carbonic anhydride when the enclosing cells are killed, or when extracted from a living plant and deposited on filter paper; similar results were obtained with Engelmann's bacteria-method.

According to Engelmann (*Ber. deut. bot. Ges.*, 1881, 446), isolated chlorophyll grains less than 0·005 mm. in diameter continue for a long time, in presence of light, to give off oxygen. The same result was obtained by Haberlandt (comp. Pfeffer, *Ber. Math.-Phys. Classe k. Sächs. Ges. Wiss. Leipzig*, 1896, 314). The author's experiments made with chlorophyll grains from many different sources give a decided negative result.

The third point considered is the question as to how far a temporary or permanent injury to the cytoplasm results in weakening the chlorophyll function. The effects of plasmolysis (Klebs, *Bot. Centr.*, 1887, 7, 166), of a constant electric current, heat, chloroform, nitric acid (1—2·5 : 10000) and ammonia were investigated. The results show that injury to the functions of chlorophyll by external influences is not exactly coincident with injury to the cytoplasm and the cell nucleus. The cytoplasm may lose its mobility without the elimination of oxygen being hindered. Constant electric currents seem to increase carbon assimilation in presence of light. N. H. J. M.

Occurrence of Glutamine in Plants. By ERNST SCHULZE (*Landw. Versuchs.-Stat.*, 1898, 49, 442—446. Compare *ibid.*, 1896, 48, 33, and Abstr., 1896, ii, 572).—Glutamine probably takes the place of asparagine in the *Caryophyllaceæ* and perhaps also in the *Chenopodiaceæ*. It was previously mentioned that the seedlings in which glutamine was found were from seeds rich in fat. Seedlings of *Papaver somniferum*, *Tropæolum majus*, and *Pinus sylvestris* (the seeds of which are rich in fat) contained, however, considerable amounts of asparagine, but no glutamine.

The seedlings previously found to contain glutamine were etiolated. Glutamine occurs also in normal seedlings of *Ricinus communis*, *Sinapis alba* and *Picea excelsa*. The greatest amount of glutamine found in seedlings was only 2·5 per cent. in the dry matter, which is much less than the amount of asparagine found in leguminous seedlings; but it is supposed that, owing to the difficulties of separating glutamine, the plants contained at least twice as much as was actually obtained.

In the case of *Cruciferæ*, glutamine occurs in the roots and tubers, but it is not to be supposed that plants which produce glutamine when germinating necessarily produce it at other periods when there is an accumulation of amides. N. H. J. M.

Tyrosine in Trifolium Pratense. By N. A. Orloff (*Chem. Centr.*, 1897, i, 1234; from *Pharm. Zeit. Rüss.*, **36**, 214).—The solution obtained by precipitating an aqueous extract of *Trifolium pratense* with lead acetate, and subsequently removing the excess of lead, produces with mercuric nitrate a precipitate which becomes red on standing or on being warmed; when this is decomposed by hydrogen sulphide, a substance is obtained which dissolves in ammonia, giving a solution that becomes turbid on adding acetic acid. These reactions probably indicate the presence of tyrosine. W. A. D.

The Question as to how far Soil Analysis can indicate the Potash requirement of Soils. By Otto Lemmermann (*Landw. Versuchs.-Stat.*, 1897, **49**, 287—339).—Field experiments were made in which oats and wheat were grown on different soils of known composition, with and without kainite. Oats were also grown in pots in soil which had been extracted with 0·06, 0·25, 0·5, 1, and 5 per cent. hydrochloric acid, and in the same soil in its natural condition; mineral manures were added to some of the pots. The amounts of total produce and the lime, magnesia, potash, and phosphoric acid in the produce are given.

From the results of the experiments, it is concluded that, for rye and wheat, potash should be applied to soil which contains less than 0 2351 per cent. of potash soluble in 10 per cent. hydrochloric acid. Soil containing more than 0·2424 per cent. of potash does not require application of potash for oats. N. H. J. M.

Composition of the Straw of Wheat, Oats, and Rye. By Balland (*Compt. rend.*, 1897, **125**, 1120—1122).—Analyses of the straw of wheat, oats, and rye from different localities show that they all contain very little assimilable matter, and that, so far as chemical composition is concerned, they are practically identical. The percentage composition varied between the following limits:—Water, 9·20 to 14·50; nitrogenous matter, 1·01 to 3·22; fats, 0·92 to 1·60; extractive matters and saccharifiable cellulose, 39·43 to 48·04; non-saccharifiable cellulose, 32·90 to 39·15; ash, 2·86 to 6·94; and acidity, 0·044 to 0·118. These variations are mainly due to the fact that the composition of the leaves, the stem and the awns is not the same, and consequently the composition of the whole varies with the proportions of these organs. The composition of the stem is also different in its upper and lower portions. Analyses are given of the different parts of one sample of oat-straw, one of rye-straw, and two of wheat-straw. Short straw with a high proportion of leaf should be selected for feeding purposes, and long straw is useful only for litter. C. H. B.

Food Value of Lucerne. By ACHILLE MÜNTZ and CHARLES A. GIRARD (*Ann. Agron.*, 1898, **24**, 1—39).—A number of samples of lucerne, and samples of stems and leaves of lucerne were analysed, whilst the digestibility of fresh and dry lucerne, of the stems and leaves respectively, and of a mixture of lucerne and grass was determined by experiments with horses.

Green lucerne is not appreciably more digestible than lucerne which has been properly dried, the nitrogenous matter being in both cases equally utilised. Contrary to what would be expected, the cellulose becomes more digestible after the lucerne is dried, but this is probably owing to the fact that the horses eat the hay more slowly, and masticate it more thoroughly, than the green fodder. The other constituents, such as the pectic and gummy substances and organic salts, are more completely digested in green than in dry lucerne.

In the following summary, the percentage amounts of total and digestible constituents of lucerne and meadow hay are compared :—

	Nitrogenous matter.		N-free extract.		Crude cellulose.	
	Total.	Digestible.	Total.	Digestible.	Total.	Digestible.
Lucerne	10·90	7·85	39·71	26·29	27·54	10·77
Meadow hay ...	6·95	4·81	47·37	34·34	23·93	16·84

Lucerne contains, therefore, 3 per cent. more digestible nitrogenous, and 14 per cent. less non-nitrogenous, matter than meadow hay. It is suggested that lucerne may be considered better than hay for the production of force, whilst meadow hay would be the more suitable for fattening.

Comparing the produce from a given area of land, it is shown that lucerne produces 162 kilos. per hectare more digestible nitrogenous matter than a natural meadow, and that if the latter produces the more digestible non-nitrogenous matter, lucerne is the more valuable crop. Moreover, lucerne utilises a greater amount of atmospheric nitrogen than is the case with mixed herbage, and enriches the soil to a correspondingly greater extent. N. H. J. M.

Composition of Hemp. By FAUSTO SESTINI and GHERO. CATANI (*Landw. Versuchs-Stat.*, 1898, **49**, 447—460).—Analyses are given of three samples of hemp stems in the natural state with the leaves and flowers, of the same number of samples of stems broken in the field, and of macerated stems. The results obtained with the natural stems of plants grown on the experiment field are as follows (per cent. in dry matter).

Organic matter.	Pure cellulose.	Ether extract.	Nitrogen.	Extractives.	Ash.
96·210	50·409	1·401	1·154	37·186	3·790

The pure ash contained (per cent.).

K_2O.	Na_2O.	CaO.	MgO.	$Fe_2O_3 + Al_2O_3$.	P_2O_5.	SO_3.	SiO_2.	Cl.
42·182	0·920	28·830	3·140	3·584	11·037	4·282	4·408	1·966

The results show that, with a normal yield of 100 cwt. of stems, the hemp crop is less exhausting than was indicated by former analyses. It is very important to break the stems on the land and to return the useless portions for manure. N. H. J. M.

Amount of Pentosans in Different Feeding Materials, and the amounts remaining in the Foods after they have been subjected to Operations. By Bernhard Tollens and Hubert Glaubitz (*Chem. Centr.*, 1897, i, 613—614; from *J. Landw.*, **45**, 97—111).—In examining the sulphuric acid and the caustic potash solutions used in determining crude fibre in brewers' grains, it was found that most of the pentosans were in the 1¼ per cent. sulphuric acid, a very small amount being found in the potash extract; some remained in the crude fibre. In meadow hay, 23·63 per cent. of the total pentosans was found in the crude fibre.

In the case of barley, malt, worts, and grains, three-fourths of the pentosans of the malt were found in the wort, the rest in the grains. Barley does not lose pentosans in germinating. In mashing, the dissolved pentosans of the malt are not all found in the wort, but in the beer also, as, even if they are partly converted into pentoses, they are not capable of alcoholic fermentation.

The determination of pentosans in food should be extended, as the digestible cellulose is equal in value to digestible starch.

N. H. J. M.

Effect of Different Potassium Salts on the Yield and Composition of Potatoes. By F. W. Theodor Pfeiffer, E. Franke, Otto Lemmermann, and H. Schillbach (*Landw. Versuchs-Stat.*, 1897, **49**, 349—385).—The experiments were made in zinc vessels containing 27 kilograms of fine sandy soil manured with blood meal, sodium nitrate, superphosphate, and caustic lime. There were six pots without potash, and thirty pots with various potassium salts.

Potassium chloride, in quantities up to 250 kilograms of potash per hectare, had the same effect as the sulphate, the chlorine having no injurious action on the growth of the potatoes. The same amount of potash, applied in the form of "crude salts" (rich in chlorides), instead of being beneficial, caused a slight decrease in the amount of starch produced. This is attributed to the presence of magnesium compounds, as well as other chlorides in the "crude salts."

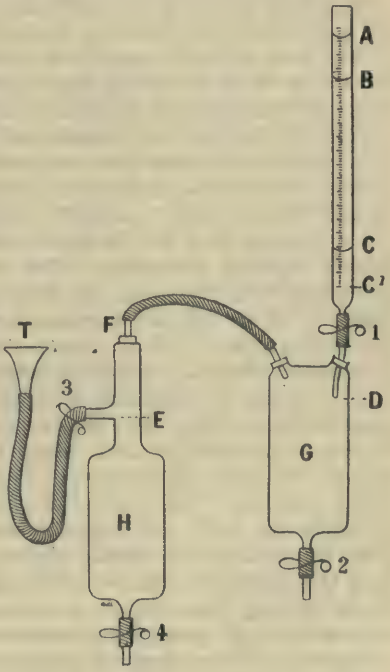
A low percentage of chlorides in soil is possibly injurious to the growth of potatoes, and in some cases the direct application of chlorides may be beneficial.

Unusually high production of starch is sometimes coincident with a very high percentage of chlorine in the tubers and above-ground growth, and it is suggested that, by cultivation under altered conditions, potatoes may gradually become accustomed to large amounts of chlorides, and may even require chlorides for producing heavy crops.

The experiments were made with one kind of potatoes (Reichskanzler), and the manures were applied in the spring immediately before sowing. These conditions are to be kept in view in considering the above conclusions. N. H. J. M.

Analytical Chemistry.

Volumetric Estimation of Hydrofluoric Acid. By JULIUS ZELLNER (*Monatsh.*, 1897, 18, 749—755).—Hydrofluoric acid can be accurately estimated by standard potash, using phenolphthalein as indicator, by first adding an excess of the alkali, heating for a short time, and then titrating the hot solution with the acid. If cold solutions are employed, the error may be as great as 1 per cent. The acid solution is weighed in a small vulcanite bottle fitted with a fine-pointed vulcanite tube that can be closed with a pinchcock. The apparatus for delivering a known volume of the acid for the final titration is as follows. The burette and the vessel *G* are of glass, whilst *H* and the funnel *T* are of vulcanite. *G* is filled with water to the level *D*, the pinchcock 1 is then closed, and 2 opened; *H* is filled to the level *E* with the acid by means of the funnel *T*, the cocks 2 and 3 are closed, and the burette filled with water. On opening the cock 1, an amount *a* of water flows into *G*, the level in the burette finally becoming stationary at *B*; the cock 4 is then opened as well as 1, and the requisite volume *x* of acid delivered, the level in the burette falling to *C*.



If *b* is the volume *BC*; *v* that of the vessel *G* together with the connecting tube *F* as far as *E*; h_1 the height *DB*, h_2 the height *CD*, and B_m that of the water barometer; then the volume $x = \frac{(v-a)(h_1-h_2)}{B_m+h_2} + b$, if the temperature remains constant throughout the experiment.

It is pointed out that a solution of hydrofluoric acid of sp. gr. = 1·148 contains 41·1 per cent. HF, and not 35·35 as stated by Bineau; contamination with hydrofluosilicic acid greatly influences the density; the author's determinations were carried out using a vulcanite pyknometer.
W. A. D.

A Source of Error in Kjeldahl's Nitrogen Estimation.—By B. SJOLLEMA (*Chem. Zeit.*, 1897, 21, 740—741).—When using zinc to prevent bumping, a small amount of hydrogen is evolved, and this carries over a certain quantity of fixed alkali, which may cause an error of 0·3 per cent. of nitrogen, or nearly 2 per cent. of nitrogenous matter.

The author has fixed to the distilling flask a specially constructed tube in which the gas is made to pass through a little water, and is consequently freed from any fixed alkali. L. DE K.

Comparative Experiments on the Estimation of Phosphoric Acid.—BY ALEXANDER CAMERON (*J. Soc. Chem. Ind.*, 1897, 16, 499—502).—When estimating the soluble phosphoric acid in superphosphate, the highest (and presumably most correct) result is obtained by treating the substance (2 grams) twice with 20—30 c.c. of cold water, and finishing the extraction with boiling water.

The most accurate method of estimation seems to be the molybdate-citrate method, in which, after first precipitating with molydate, 0·1 gram of citric acid is added to the ammoniacal solution of the yellow precipitate before the addition of the magnesia mixture. Without this addition of citric acid, the results are unquestionably above the truth. A more rapid method, and one which does not involve the use of molybdate, is the "citrate" method. Although this method gives lower results, they can be made to agree with those of the molybdate-citrate method by adding 1/50 to the weight of the magnesinm pyrophosphate obtained. A weighed quantity of citric acid is added (varying from 0·3 to 2 grams according to the class of phosphate and the amount of iron present, but kept as low as possible, since increase of citric acid leads to deficiency in the result). The liquid is boiled, excess of ammonia is added, then excess of acetic acid and ammonium oxalate. The calcium oxalate is filtered off and washed, the filtrate and washings not being allowed to exceed 200 c.c. The phosphoric acid is then thrown down with magnesia mixture in the usual manner. The precipitate should, however, be redissolved in hydrochloric acid and reprecipitated by ammonia after adding 0·1 gram of citric acid. Should the result be required rapidly, filtration may take place 10 minutes after adding the magnesia mixture (the liquid having been stirred continuously meanwhile), but in that case the weight of precipitate obtained should be increased by one milligram. When iron or aluminium is present, the calcium oxalate precipitate will contain a little of the phosphoric acid, but, on the other hand, the weight of the magnesia precipitate will be slightly increased. M. J. S.

Estimation of Citrate-soluble Phosphoric Acid in Basic Slag.—BY MAX PASSON (*Zeit. angw. Chem.*, 1897, 746. Compare Abstr., 1897, ii, 230).—Instead of Wagner's solution, which contains ammonium citrate and free citric acid, but which is difficult to prepare of the exact strength, the author recommends a solution made by dissolving 140 grams of citric acid and 30 grams of neutral potassium citrate and making up to a litre. L. DE K.

Estimation of Citrate-soluble Phosphoric Acid in Basic Slag. By O. BÖTTCHER (*Chem. Zeit.*, 1897, 21, 783—785).—The author again recommends the direct precipitation with magnesium mixture instead of the troublesome molybdate method. Five grams of the sample, which should be weighed in the same state as received, is introduced into a half-litre flask, which is then filled with Wagner's dilute ammonium citrate solution, and rotated for 30 minutes at the rate of 30—40 rotations per minute. The liquid is poured off from the deposit and at once passed through a filter.

Fifty c.c. of this filtrate is mixed as soon as possible, or, at all events, the same day, with 25 c.c. of Märcker's citrate solution and of his magnesium mixture, and agitated in a shaking apparatus for 30 minutes; the magnesium phosphate precipitate is then at once collected in a Gooch's crucible, washed, dried, ignited, and weighed.

L. DE K.

Detection of Arsenic and Antimony. By PONTUS H. CONRADSON (*J. Soc. Chem. Ind.*, 1897, **16**, 518—519).—Hager's test for arsenic is sufficiently sensitive, but does not distinguish arsenic from antimony, and is useless if hydrogen sulphide is evolved with the hydrogen arsenide. The author employs four test papers, all of which are to be freshly prepared and used wet. Nos. 1, 2, 3 are prepared by placing drops of lead acetate, silver nitrate, and mercuric chloride solutions respectively in the middle of pieces of filter paper large enough to cover the test-tube. No. 4 is prepared by putting two drops of nitric acid (sp. gr. = 1·2) on the paper, and then two drops of potassium iodide solution (1 : 10) in the middle of the nitric acid spot. Either zinc or magnesium may be used to generate hydrogen from dilute sulphuric acid, and these materials must first be tested for sulphur, arsenic, and antimony by causing the evolved gas to act on papers 1 and 2 in succession for 15 minutes each. The substance is then added, and (with a slow evolution of gas) the papers are applied in the order of their numbers, and each exposed for 15 minutes. No. 2 is blackened by both arsenic and antimony; No. 3 acquires a lemon-yellow to orange-brown colour with arsenic, but a brownish-grey tint free from yellow with antimony; No. 4 becomes bright yellow to orange with antimony, but is not affected by arsenic or by pure hydrogen.

M. J. S.

Comparison of Rapid Methods for Estimating Carbonic Anhydride and Carbonic Oxide. By LOUIS M. DENNIS and C. G. EDGAR (*J. Amer. Chem. Soc.*, 1897, **19**, 859—870). The authors have experimented with the apparatus devised by Honigmann, Bunte, Orsat, Elliot, and Hempel, and have tabulated the results.

All these various apparatus work within 1 per cent., and with the exception of the first-named even within half a per cent. As regards speed and convenience none are equal to the Hempel apparatus. As in the Bunte and Elliot methods the aqueous potash can only be used once, these methods are very wasteful.

L. DE K.

Estimation of Potassium by Reduction of Potassium Platinochloride by means of Sodium Formate. By B. SJOLLEMA (*Chem. Zeit.*, 1897, **21**, 739—740).—The author, after pointing out some defects in the commercial processes recently proposed for the estimation of potassium, now recommends that devised by Corenwinder and Contamine.

According to these authors, a solution containing 0·5 gram of the material is acidified with hydrochloric acid, mixed with excess of platinic chloride, and evaporated on the water bath to a syrupy consistence; when cold, the residue is treated with a mixture of 9 parts of 95 per cent. alcohol and 1 part of ether, and after some hours the insoluble matter is collected on a filter and washed with the same mixture. It is then dissolved in boiling water and boiled with a solution of sodium formate; this reduces the platinum, which, after being washed first with acidified water and then with boiling water, is ignited and weighed. One atom of platinum corresponds with 2 atoms of potassium.

The author, however, prefers washing with 90 per cent. alcohol, instead of the mixture of alcohol and ether. L. DE K.

Analysis of Limestones. By KARL J. SUNDSTRÖM (*J. Soc. Chem. Ind.*, 1897, **16**, 520).—An analysis embracing the estimation of the calcium and magnesium carbonates, silica and alumina and ferric oxide with sufficient accuracy for technical purposes, can be completed in 2—3 hours by the following scheme. One gram of substance is dissolved in 25 c.c. of normal hydrochloric acid, and the excess of acid estimated by normal alkali, using methyl-orange as indicator. A second gram is dissolved in acid, and the solution evaporated for silica. The filtrate from the silica is precipitated with ammonia for aluminium and iron, and the filtrate from this precipitate is mixed while boiling with a boiling solution of ammonium oxalate. After two or three minutes, the clear liquid can be decanted on to a filter. The precipitate is dissolved in hydrochloric acid and reprecipitated by ammonia, and weighed as calcium oxide after washing and igniting over a blast lamp. The magnesium is calculated from the difference between the acid neutralised and that required by the calcium found.

M. J. S.

Electrolytic Estimation of Cadmium. By DANIEL L. WALLACE and EDGAR F. SMITH (*J. Amer. Chem. Soc.*, 1897, **19**, 870—873).—The authors (compare Abstr., 1896, ii, 220) state that Heidenreich's failure to obtain correct results with Smith's electrolytic process is probably due to the use of a current of different strength. Two experiments are communicated, showing that 50 c.c. of a solution containing about 0·13 gram of cadmium oxide in the form of acetate deposited all the metal when electrolysed at a temperature of 50° with a current of 0·02 ampère for 37 sq. cm. of cathode surface, voltage 3·5, the time required for complete precipitation being about 4 hours.

The same amount of cadmium oxide dissolved in 2 c.c. of dilute sulphuric acid of sp. gr. = 1·09 and diluted to 30 c.c., deposited all the metal when electrolysed for 4½ hours at 50° with a current of 0·08 ampère for 37 sq. cm. cathode surface, voltage 2·5. The electrolytic process may also be employed for the separation of copper from cadmium if the liquid contains free nitric acid. A solution containing about 0·1 gram of cadmium, and the same amount of copper per 100 c.c., and also 2 c.c. of strong nitric acid, when heated to 50° and electrolysed with a current $N.D._{100} = 0·10$ ampère, voltage 2·5, deposits the copper completely in 3 hours, leaving all the cadmium in solution. L. DE K.

Volumetric Estimation of Zinc. By EDWARD G. BALLARD (*J. Soc. Chem. Ind.*, 1897, 16, 399—400).—In titrating zinc solutions by sodium sulphide, the point at which an excess of sulphide is first present is very accurately ascertained by placing a drop of the mixture on a bright plate of silver (cleaned with chalk and ammonia), allowing it to remain for 10 or 20 seconds, and then wiping off with filter paper. One part of sodium sulphide in 20,000 of water will produce a stain. In cases where the amount of zinc is not known approximately, time may be saved by adding an excess of sulphide at once and titrating back with a zinc solution, watching the disappearance of the stain on silver. As zinc sulphide in presence of a large excess of ammonia blackens the silver, an excess of ammonia must be avoided as far as possible if working in the cold, but at 82° a much larger amount of ammonia may be present without disturbing the result.

M. J. S.

Estimation of Cerium in the Presence of the Rare Earths. By GEORG VON KNORRE (*Zeit. angw. Chem.*, 1897, 685—688; 717—725). —The mineral is boiled with sulphuric acid, and after diluting with water, the metals of the cerium group are precipitated with oxalic acid so as to free them from titanic and phosphoric acids; the oxalates are ignited, the residue dissolved in sulphuric acid, diluted, and a little persulphuric acid added to peroxidise the cerium; the excess of the reagent is then removed by boiling.

To the cold solution, an excess of a solution of hydrogen peroxide, previously standardised with potassium permanganate, is then added to reduce the metal to the cerous state. The undecomposed hydrogen peroxide is again titrated with permanganate, and the difference between the two titrations noted; if the permanganate solution has been standardised with metallic iron, 56 parts of the latter correspond with 140 parts of cerium.

L. DE K.

Methods of Analysis of Chrome Salts. By HENRY R. PROCTOR (*J. Soc. Chem. Ind.*, 1897, 16, 412—414).—Chromic acid is most conveniently estimated by causing it to liberate iodine from acidified potassium iodide. It is quite sufficient to mix the solution (containing not more than 0·01 gram of potassium dichromate or its equivalent) with 1 gram of potassium iodide and 5 c.c. of concentrated hydrochloric acid in a stoppered bottle, and allow a few minutes to elapse before titrating with thiosulphate. To ascertain the extent to which the chromic acid is combined with alkali, the solution may be directly titrated with standard alkali, using as indicator phenolphthalein to which normal chromates are neutral, whilst dichromates are acid. If chromic salts are also present, they are very readily oxidised to chromates by boiling with excess of permanganate after making alkaline with sodium hydroxide. The excess of permanganate is removed by cautious addition of alcohol to the boiling solution until the pink colour disappears.

M. J. S.

Separation of Tin, Arsenic, and Antimony. By WILLIAM DANCER (*J. Soc. Chem. Ind.*, 1897, 16, 403—405).—On treating the sulphides of the above metals with an excess of lime-water, the tin sulphide is converted into an insoluble, white substance, which, after heating to about 80°, can be readily filtered and washed with boiling water; the antimony and arsenic sulphides dissolve, although the latter partially precipitates again in a short time. If arsenic is absent, the antimony can be recovered as sulphide by adding an excess of acid to the filtrate. If the arsenic does not amount to more than 5 or 6 per cent. of the tin, the whole of it will be present in the filtrate from the tin precipitate, and may be separated from the antimony by adding ammonia (5 c.c. to each 100 c.c. of solution), heating to near boiling, and adding acetic acid drop by drop until a small, permanent precipitate is formed. A short boiling then precipitates the antimony as sulphide, and after filtering hot, the arsenic is obtained by adding hydrochloric acid to the filtrate. If, however, the arsenic exceeds the above proportion, the tin precipitate must be dissolved in yellow ammonium sulphide, the solution diluted and boiled, lime added gradually, and the boiling continued until the ammonia is nearly all expelled. The liquid is then cooled and filtered, and the arsenic precipitated from the filtrate by hydrochloric acid. The tin precipitate which contains calcium is ignited and boiled with dilute nitric acid to remove calcium. If the arsenic is in excess, repetitions of the processes may be necessary. M. J. S.

Volumetric Estimation of Antimony. By HENRI E. CAUSSE (*Compt. rend.*, 1897, **125**, 1100—1103).—When antimonious acid, either free or in combination, is brought into contact with iodic acid, decomposition takes place in accordance with the equation $5Sb_2O_3 + 2I_2O_5 = 5Sb_2O_5 + 2I_2$, and the liberated iodine can be estimated in the usual way with thiosulphate solution. The iodic acid solution is prepared by dissolving 50 grams of the acid in 250 c.c. of water. The antimony compound, containing from 0·5 to 0·6 gram of antimonious anhydride, is placed in a flask connected with a set of condensing bulbs (Mohr or Fresenius' apparatus) and mixed with 20 to 25 c.c. of the iodic acid solution. Ten c.c. of a 20 per cent. solution of potassium iodide is placed in the condenser, and the liquid in the flask is boiled until all the iodine has been expelled. The iodine solution in the condenser is diluted with water and titrated in the usual way.

Antimony can be determined in this way in any of its compounds. The metal is precipitated as sulphide, washed, dissolved in hydrochloric acid, and after expelling all the hydrogen sulphide, precipitated with sodium carbonate. The precipitate, when washed, may be heated directly with the iodic acid solution, or may be first dissolved in tartaric acid, or sodium hydrogen tartrate, neither of which has any action on iodic acid. All acids such as the halogen hydracids, sulphurous acid, or hydrogen sulphide, that interact with iodic acid, must, of course, be absent from the liquid.

C. H. B.

Analysis of Bearing Metal Alloys; New Volumetric Method for Estimating Copper. By W. E. GARRIGUES (*J. Amer. Chem. Soc.*, 1897, **19**, 934—948).—The most interesting point in this elaborate article is a new method of estimating copper.

The solution, which must contain sulphuric acid only, is mixed with excess of sulphurous acid and precipitated by means of ammonium thiocyanate, precipitation being promoted by gently heating; after the precipitate has been washed until no longer acid, the filter and its contents are put back into the beaker, boiled with a measured excess of standard alkali, and, when cold, diluted to a known volume, say 200 c.c. Half the liquid is then passed through a dry filter and the free alkali is estimated with standard acid, using methyl-orange as indicator. One equivalent of sodium hydroxide removed is equivalent to one of copper.

The following is a summary of the process for a complete analysis. Antimony is estimated by Mohr's method: titration with iodine in alkaline solution, the antimony being first reduced by Gooch and Gruener's method (Abstr., 1892, ii, 242). Lead is estimated as sulphate, being collected on a Gooch crucible, dried (not ignited), and weighed. Tin is weighed as oxide, or, in presence of antimony, is determined by difference in weight. Arsenic is determined by Lundin's distillation process, and phosphorus is weighed as magnesium pyrophosphate. L. DE K.

Colorimetric Estimation of Ammonia, Nitrous Acid, and Iron in Waters. By F. JOSEF KÖNIG (*Chem. Zeit.*, 1897, 21, 599—601).—The author tests for ammonia by adding to 300 c.c. of the water 2 c.c. of a soda solution made by dissolving 2·7 grams of pure crystallised sodium carbonate in 5 c.c. of water, and adding 1 gram of sodium hydroxide dissolved in 2 c.c. of water. The clear liquid is then poured off and tested with Nessler's solution. Nitrites are tested for by first clarifying the water, if necessary, with the soda solution after having previously added a little alum; the filtrate is then treated with zinc iodide, starch solution, and dilute sulphuric acid. Iron is found by boiling 500 c.c. of the sample with 1 c.c. of hydrochloric acid and a crystal of potassium chlorate, cooling, and adding a solution of ammonium thiocyanate. If a quantitative estimation be desired, comparative trials are made with liquids containing known quantities of either ammonium chloride, silver nitrite, or iron-alum.

To avoid using standard solutions, the author instructed an artist to copy the tints produced in 100 c.c. of the standard solution by the reagents, and has had these tints reproduced by lithography. Six graded slips, whose length and breadth are equal to the height and diameter of a Nesslerising tube filled to the 100 c.c. mark, are arranged as the faces of a hexagonal prism on a stand, so that they may be rotated round its vertical axis and successively compared with a Nessler glass containing the sample to be tested, which is supported on an arm of the same stand. The slips are marked with the quantity of the impurity in 100 c.c. to which they correspond, but on account of personal equation, it is advisable that each operator should himself prepare his standard solutions and make the necessary corrections. After adding the reagent, the liquid should, if necessary, be diluted so as to make its colour correspond with one of the tints.

L. DE K.

Estimation of Mineral Matter in Rubber Goods. By LEONARD DE KONINGH (*J. Amer. Chem. Soc.*, 1897, 19, 952—956).—The ash of a rubber does not always represent the true amount of mineral matter, as the latter often diminishes seriously in weight during ignition. The author, therefore, proposes to first extract the bulk of the mineral matter with hydrochloric acid; for this purpose, 5 grams of the finely divided (rasped) sample is treated with 50 c.c. of strong hydrochloric acid, first in the cold and subsequently at a temperature of 70°, for an hour; 50 c.c. of water is then added and the insoluble matter, after being collected on a filter and washed with boiling water until no longer acid, is dried finally for 3 hours at 105°, and weighed. The little inorganic matter still remaining in it is found by ignition.

L. DE K.

Analysis of Asphaltum. By STEPHEN F. and H. E. PECKHAM (*J. Soc. Chem. Ind.*, 1897, **16**, 424—427).—The authors criticise adversely the paper of H. Endemann (this vol., ii, 199), mainly on the ground that he omitted to notice the sulphur which is contained in crude bitumen, and which they regard, on grounds for which they produce no evidence, as existing in the form of an organic thio-salt of iron and as an essential part of the bitumen.

ENDEMANN, in reply, states that the substances which he analysed, and for which he gave formulæ, contained only traces of sulphur, and he attributes the hydrogen sulphide, which is produced in large quantity when crude bitumen is heated, to a reaction between iron pyrites and the hydrocarbons of the paraffin series which are always present in the substance. M. J. S.

Estimation of Glycerol in Wine. By CARL BOETTINGER (*Chem. Zeit.*, 1897, **21**, 658—659).—The glycerol obtained from wines by the conventional process being still strongly contaminated with other constituents of the wine, the author has devised a method to ascertain the true amount of glycerol; this is based on the fact that glycerol, when heated with acetic anhydride, yields triacetin which may be separated by means of ether.

About 1 gram of potassium pyrosulphate is introduced into a stoppered flask of about 7·5 c.c. capacity and after the whole has been weighed, about 1 gram of the crude glycerol is introduced and its exact weight ascertained by re-weighing; 1—1·5 c.c. of acetic anhydride is now added, and the closed flask is then placed for 2 hours in the water oven. When cold, the mass is moistened with a few drops of absolute alcohol and then repeatedly extracted with ether, the ethereal solution evaporated in a tared beaker, and the residue heated for 4 hours at a temperature of exactly 105°; when cold, the residue is quickly weighed. It consists of almost pure triacetin, 151·4 parts of which correspond with 100 parts of glycerol. L. DE K.

Estimation of Cane-sugar in Prepared Cocoa. By LEONARD DE KONINGH (*Zeit. angw. Chem.*, 1897, 713).—16·35 grams of the sample is introduced into 100 c.c. of water, and after thoroughly stirring for about 10 minutes, the solution is filtered; 50 c.c. of the filtrate is then mixed with 5 c.c. of *liquor plumbi*, B.P., and the filtrate examined in a Dubosq's polariscope, using a 22 cm. tube.

Suppose the polarisation is 47°, this is provisionally called the percentage of sugar in the sample. 16·35 grams of cane-sugar, when dissolved in water, causes an increase of 10·2 c.c. of liquid; the sample containing 47 per cent., or $16 \cdot 35 \times 0 \cdot 47 = 7 \cdot 68$ grams of sugar, will have caused the liquid to increase by 4·8 c.c. The true amount of cane-sugar is therefore represented by $47 \times 104 \cdot 8/100$. This way of calculating is, of course, not strictly accurate, but it meets practical requirements. The author has never met with a pure cocoa which, when treated with a properly prepared lead solution, showed any polarisation.

L. DE K.

Characteristic Colour Reaction of Acetaldehyde. By LOUIS SIMON (*Compt. rend.*, 1897, **125**, 1105—1107).—When a dilute aqueous solution of acetaldehyde is mixed with a small quantity of a solution of trimethylamine, and a few drops of a very dilute solution of sodium nitroprusside is added, an intense blue coloration gradually develops, which is recognisable even with solutions that contain 1 part of acetaldehyde in 25,000. This reaction is much more sensitive than Legal's reaction, or the reaction with magenta and sulphurous acid, but the coloration is somewhat fugitive, and disappears after about 15 minutes in very dilute solutions.

This reaction is characteristic of acetaldehyde; it is not given by paraldehyde, chloral, formaldehyde, propaldehyde, butaldehyde, benzaldehyde, acetone, methyl ethyl ketone, acetophenone, bromacetophenone, benzophenone, phenylglyoxylic acid, glucose, or camphor. It can, therefore, be used, for example, for the detection of aldehyde in ether, alcohol, or acetone. The last compound gives a red coloration with the reagent, but this is completely masked by the blue colour when the proportion of aldehyde reaches 1 part in 1000.

Ammonia and amines give a blue coloration with pyruvic acid in presence of nitroprussides (this vol., i, 64), but ammonia and a nitroprusside give no coloration with aldehyde. Ammonia, on the contrary, destroys the colour produced by trimethylamine, and thus constitutes a striking difference between the amine and ammonia.

Potassium hydroxide, when added to the blue solution, displaces the amine, and the blue coloration gives place to the red colour of Legal's reaction. Acetic acid changes the blue colour to violet, and then destroys it.

C. H. B.

Estimation of the Acidity of Urine. By H. JOULIE (*Compt. rend.*, 1897, **125**, 1129—1130)—The acidity of urine is best estimated by means of a solution prepared by agitating 10 grams of calcium oxide for some time with a solution of 20 grams of cane-sugar in 1000 c.c. of water, and diluting the clear liquid until it is decinormal. The point of neutralisation is best indicated by the production of a permanent turbidity due to the precipitation of calcium phosphate. The quantity of urine taken for the estimation should be 20 c.c., or such greater quantity as may require not less than 5 c.c. of the calcium oxide solution to neutralise it. If necessary, the urine must be previously filtered.

Since the proportion of water in urine is very variable, whilst the quantity of solid matter is somewhat constant, it is important to ascertain, not the acidity per litre, but the acidity per given quantity of solid matter. For this purpose, the acidity per litre is multiplied by the fraction $100/D - 1000$, in which D is the specific gravity at the temperature at which the urine was measured off for the acidity determination. The value thus obtained is characteristic of the temperament of the individual in normal health, or of his pathologic condition during illness. C. H. B.

Reaction of Urine. By L. DE JAGER (*Zeit. physiol. Chem.*, 1898, **24**, 303—321).—Various errors are considered in the methods adopted by Lieblein and by Freund in the estimation of the acidity of urine, and numerous experiments with various solutions of phosphates were made, but it is pointed out that urine is a complex solution, and contains ammonia, and also urates, which affect the reaction. When barium chloride is added, barium sulphate, acid barium phosphate, and barium urate are formed, but some uric acid remains in solution. W. D. H.

Hehner's Bromine Thermal Test for Oils. By LEONARD ARCHBUTT (*J. Soc. Chem. Ind.*, 1897, **16**, 309—311, and 411.) The author having obtained considerable experience in the application of this method (this vol., ii, 197), confirms its value as a rapid process for ascertaining the iodine absorption of an oil, and describes in detail his mode of conducting it. The oil having been weighed into the vacuum-jacketed tube and dissolved in 10 c.c. of methylated chloroform, is brought to exactly the same temperature as the bromine, and 1 c.c. of the latter (measured with a pipette furnished with a guard tube of soda lime) is immediately added. The mixture is stirred with the thermometer, and the maximum temperature, which is reached in about 15 seconds, is read off. It is unimportant whether the bromine is anhydrous or saturated with water, and the rise of temperature seems to be independent of variations in the initial temperature. Although 1 gram of oil is usually employed, it is well to use 2 grams of fats like tallow, which develop comparatively little heat, and to halve the result. Of linseed oil, 0·5 gram is sufficient, as the reaction is very violent. Each oil requires, however, a special factor for the calculation of the iodine number, and as these factors differ with different instruments, they must be ascertained by each operator for himself. M. J. S.

Analysis of Fats: The Acetyl Value. By JULIUS LEWKOWITSCH (*J. Soc. Chem. Ind.*, 1897, **16**, 503—506).—The author has previously shown (Proc., 1890, 72, 91; Abstr., 1891, 511) that, on heating the higher fatty acids with excess of acetic anhydride, the anhydrides of the fatty acids are obtained. When these are dissolved in alcohol and treated with potash, partial but incomplete hydrolysis occurs, less potash being neutralised than the theoretical amount for the fatty acid in question. The method employed by Benedikt and Ulzer for ascertaining the amount of hydroxylated fatty acid in a mixture is invalidated by the occurrence of these reactions. It is therefore proposed to ascertain the "acetyl value" of a fat by the direct estimation of the acetic acid obtained on saponifying the acetylated fat. The glycerides of hydroxylated fatty acids are acetylated by boiling for 2 hours with an equal volume of acetic anhydride. The product is freed from the excess of acetic anhydride by boiling repeatedly with water until the water no longer becomes acid. The oily layer is then freed from water, and filtered through paper in an oven. The operation can be made quantitative by washing on a weighed filter, in which case the increase in weight is a rough measure of the amount of acetylation which has taken place. A weighed quantity of the product (2—4 grams) is then saponified with alcoholic potash in the usual way, the alcohol is evaporated, and the soap dissolved in water; two methods are then available for ascertaining the amount of acetate produced. (1) The "*distillation process.*" An excess of sulphuric acid is added and the acetic acid distilled with water, or by blowing steam through the mixture. It is sufficient to distil over 500—700 c.c. The distillate is filtered and titrated with alkali. (2) The "*filtration process.*" A quantity of standard sulphuric acid is added exactly corresponding with the amount of alcoholic potash used, and the mixture is gently warmed, when the fatty acids collect as an oily layer; this is filtered off and washed with boiling water, and the filtrate is titrated with alkali. Both processes give the same result, but the second is the more convenient. The "acetyl value of a fat" is therefore definable as the number of milligrams of potassium hydroxide required for neutralising the acetic acid obtained on saponifying 1 gram of the acetylated fat. The results obtained with 14 different fats are given, and these differ considerably from those published by Benedikt and Ulzer.

Should free alcohols be present, these will of course be acetylated. In this case, the alcohols must be separated, and their amount and acetyl value estimated and deducted before employing the results for the calculation of the hydroxylated fatty acids present. The case of fats containing volatile fatty acids (Reichert values) will be dealt with subsequently. M. J. S.

Estimation of Fat. By OSVALDO POLIMANTI (*Pflüger's Archiv*, 1898, **70**, 366).—The use of Soxhlet's apparatus alone will not extract all the fat from flesh. If, however, 2 grams of powdered flesh is shaken for 6 hours with 200 c.c. of ether, 2 c.c. of mercury being also added, and the fat then estimated in an aliquot part of the extract, the same figure is obtained as by extraction in a Soxhlet's apparatus for 48 hours after artificial gastric digestion as in the Pflüger-Dormeyer method. W. D. H.

Estimation of Undigested Fat and Casein in Fæces. By HERMAN POOLE (*J. Amer. Chem. Soc.*, 1897, **19**, 877—881).—The material is first extracted with ether, the ethereal solution evaporated to dryness at 100°, and the residue saponified by alcoholic potash; water is then added, and after the alcohol has been expelled by boiling, the liquid is filtered and the cholesterol removed by shaking in a separating funnel twice in succession with an equal bulk of ether. The aqueous liquid now contains the fatty acids, which are liberated and collected in the usual way, and calculated to, say, butter-fat.

The residue from the treatment with ether, after being extracted successively with water and with alcohol, is dried, and digested overnight in a mixture of 30 parts of hydrochloric acid and 70 parts of water at 50°; this dissolves the casein, leaving the epithelium *débris* and soapy matters. When cold, the liquid is filtered, evaporated, and the casein estimated by the Kjeldahl method. L. DE K.

Detection of Veratrine. By G. Laves (*Zeit. anal. Chem.*, 1898, **37**, 61; from *Pharm. Zeit.*, **37**, 338).—Three or four drops of a 1 per cent. solution of furfuraldehyde is mixed with 1 c.c. of concentrated sulphuric acid and 3—5 drops of the mixture is brought in contact with the solution to be tested. At the point of contact, a blue or bluish-violet colour appears, and this changes to green as it extends into the reagent. On mixing, the whole becomes deep green, which changes on warming to blue and violet. M. J. S.

Estimation of Resin in Hops. By Lawrence Briant and Charles S. Meacham (*J. Fed. Inst. Brew.*, 1897, **3**, 233—236).—About 4 grams of the sample are placed in a Soxhlet apparatus and extracted for 24 hours with light petroleum boiling at about 50°. The soft resins so extracted are dried in the steam oven and weighed. The extraction of the residue in the Soxhlet apparatus is then continued for 12 hours more with ordinary ether, and the hard resins obtained in this way are dried and weighed in the same manner.

A. C. C.

Estimation of Tannin. By Leopold Maschke (*Zeit. anal. Chem.*, 1898, **37**, 51—52; from *Ding. poly. J.*, **302**, 46).—The usual way of correcting the crude result obtained by estimating the solid residue before and after treatment with hide powder, is to make a blank experiment with the hide powder under similar conditions, and to ascertain the amount of soluble matter thus obtained; the author points out, however, that these soluble constituents of the hide powder are for the most part precipitated by tanning materials, and that the correction is, therefore, too large. Especially is this the case with inferior qualities of hide powder.

The Löwenthal-Schröder method is affected in the same way.

M. J. S.

Detection of Indican in Urine. By A. Loubiou (*Chem. Centr.*, 1897, i, 620; from *Rev. Chim. anal. appl.*, **5**, 61—62).—One to two c.c. of the urine is mixed in a test-tube with an equal volume of chloroform and 1 c.c. of 5—10 per cent. solution of hydrogen peroxide; 2 volumes of strong hydrochloric acid is next added, and the mixture gently heated, turning the tube meanwhile at least twenty times round its axis. On standing, it will be noticed that the layer of chloroform is blue if indican is present. The test is very sensitive and may, perhaps, form the basis of a colorimetric estimation of indican. L. de K.

Detection of Peptone (Albumoses) in Urine and Preparation of Urobilin. By Ernst L. Salkowski (*Chem. Centr.*, 1897, i, 1133—1134; from *Berl. klin. Woch.*, **34**, 353—357).—The author finds that the test for peptone or albumoses in urine, previously described by him (Abstr., 1894, ii, 372), which consists essentially in acidifying the urine with a few drops of hydrochloric acid, precipitating with phosphotungstic acid, dissolving the precipitate in dilute sodium hydroxide solution, and applying the biuret reaction, may be vitiated by the presence of urobilin, as the latter gives this reaction and is mechanically carried down by the phosphotungstic acid precipitate.

Some urines, however, and even those which show absorption bands plainly, do not give the biuret reaction, but in such cases, after precipitating with phosphotungstic acid and applying this test, absorption bands may be detected. Since lead acetate in acid or neutral solution not only precipitates urobilin but also more or less albumose, in order to test for the latter in presence of the former, the author prefers to treat the urine directly with phosphotungstic acid and then to employ only 10—15 c.c. for the biuret test, so as to minimise the effect of the colouring matters. By using amylic alcohol or charcoal to eliminate the urobilin, albumoses may also be removed; when charcoal is employed, the operation should be carried out as quickly as possible.

The author has prepared urobilin from urine by Jaffé's method, but obtained a very poor yield. Urobilin forms a lustrous, reddish-brown mass which is green by reflected light; unlike Jaffé's preparation, it is brittle and insoluble in ether. When a solution of urobilin in ethylic acetate is shaken with water, the latter becomes strongly yellow and absorbs the whole blue and violet portion of the spectrum. When sodium hydroxide solution is added, this absorption is almost destroyed, but, on adding zinc chloride, the absorption bands are restored and the solution acquires a strong green fluorescence; by means of this reaction, as little as one-seventh of a milligram in 5 c.c. of solution may be detected. When copper sulphate is added to an alkaline 0·003 per cent. solution of urobilin, the mixture becomes red and shows ill-defined absorption bands. Urine containing only 0·003 per cent. of urobilin gives only a very faint biuret reaction, but with ammonia and zinc chloride shows the characteristic green fluorescence. Fæces are rich in urobilin. E. W. W.

A Simple Albuminometer. By E. Riegler (*Chem. Centr.*, 1897, i, 558; from *Apoth. Zeit.*, 12, 89).—A mixture of equal parts of citric acid and asaprol is measured in a spoon belonging to the apparatus and introduced into a graduated tube, which is then filled up to a certain mark with the urine to be examined. After shaking and then leaving it for 24 hours, the volume of the deposit is read off. Each division represents 1 gram of albumin in a litre of urine (compare Abstr., 1897, ii, 84). L. de K.

Estimation of Proteids by Chlorine. By Samuel Rideal and C. G. Stewart (*Analyst*, 22, 228—233).—The authors' object was to obtain a trustworthy process for the estimation of gelatin in meat extracts, and they find that it can be completely precipitated from a dilute solution by means of a current of chlorine. The weight of the precipitate, after being dried in a vacuum over sulphuric acid, is to the gelatin taken as 1 : 0·78. Meat bases are not precipitated by chlorine.

Unfortunately, any albumins, or albumoses, are also precipitated by chlorine (a fact already noted by Mulder, who called the precipitated substance "proteinchlorous acid"), but it is found that the weight of the chlorine precipitate from any proteid (other than peptone), when multiplied by 0·78, gives results which seem to be in close accord with the known amount. L. de K

Improved Method of Estimating Proteids and Gelatinous Substances. By ALFRED H. ALLEN and A. B. SEARLE (*Analyst*, **22**, 258—263).—The authors have substituted bromine water for chlorine in the separation of proteids from meat bases (see preceding abstract). Both albumoses and gelatin are precipitated and may be readily collected; after washing slightly with dilute bromine water, the precipitate is treated by Kjeldahl's process, and from the nitrogen thus found the proteids are calculated. Experiments are given showing that the precipitation by bromine is complete. The solution should contain sufficient hydrochloric acid to be distinctly acid to litmus paper. L. DE K.

Detection of Gelatin in Cream. By ALFRED W. STOKES (*Analyst*, **22**, 320—321).—Mercury is dissolved (? in the cold) in twice its weight of nitric acid of sp. gr. = 1·42, and then diluted with water to 25 times its bulk. To 10 c.c. of this solution, 10 c.c. of the sample of cream and 20 c.c. of water are added. After shaking, and waiting for 5 minutes, the mixture is filtered; but if much gelatin is present, a clear filtrate cannot be obtained. The filtrate is tested for gelatin by adding an equal volume of a cold saturated aqueous solution of picric acid, which will give a yellow precipitate if gelatin is present. Picric acid gives a precipitate with 1 part of gelatin in 10,000 of water. L. DE K.

Urobilin. By GEORGES DENIGÈS (*Chem. Centr.*, 1897, i, 1128—1129. See this vol., i, 343).

Modification of the Method for the Detection of Urobilin in Urine. By G. LEO (*Chem. Centr.*, 1897, i, 440; from *Boll. Chim. Farm.*, **36**, 69—70).—The precipitate obtained on adding basic lead acetate to 150—200 c.c. of the sample, after being washed with water until practically free from soluble lead salts, and then with 8—10 c.c. of absolute alcohol, is treated with 10—12 c.c. of alcoholic ammonia (10 vols. of alcohol and 2 vols. of aqueous ammonia), the liquid being poured again and again through the filter. The ammoniacal solution is then concentrated on the water bath and tested for urobilin with ammoniacal zinc chloride, which gives a fluorescent, green solution; sulphuric acid changes this to a reddish colour if care is taken to avoid any rise of temperature. The colouring matter may be extracted by agitating the liquid with amylic alcohol. L. DE K.

Detection of Horseflesh in Sausages. By HERMANN BREMER (*Chem. Centr.*, 1897, i, 520—521; from *Forsch. Ber. Lebensm.*, **4**, 1—8).—The sample, freed from large pieces of pork, is boiled with water, which is then poured off, together with any fat floating on it, and the residue dried for 12 hours at 100°. It is then powdered, exhausted with light petroleum, the latter evaporated, and the residue consisting of "intermuscular fat" is weighed. This fat should give an iodine figure of 65, and its liquid fatty acids isolated by the zinc-ether process a figure of 95. If these figures are largely exceeded, horseflesh is present. L. DE K.

General and Physical Chemistry.

Connection between Volume Change and Specific Rotation of Active Substances. By RICHARD PŘIBRAM and CARL GLÜCKSMANN (*Monatsh.*, 1897, **18**, 510—526. Compare Abstr., 1897, ii, 534.)—Solutions of rubidium tartrate show a maximum contraction in volume at a point corresponding with about 5 per cent. of the dissolved salt. A change in the direction of the specific rotation curve also occurs at about the same point with these solutions. These changes in specific rotation show that the values calculated by extrapolation for solutions of infinite dilution on the one hand, and for the anhydrous compounds on the other, must have a very uncertain value. Rimbach (Abstr., 1895, ii, 301) examined rubidium tartrate solutions, but failed to note the change recorded above, and hence his calculation of $[\alpha]_D$ cannot be regarded as correct.

For the change in specific rotation with change in concentration, the authors propose the term "allaxis." Where the change is a regular one and the curve is rectilinear, it is termed "isallactic"; when the curve is not rectilinear, "heterallactic." H. C.

Spectrum of Cadmium in a Vacuum. By MAURICE HAMY. (*Compt. rend.*, 1898, **126**, 231—234).—The wave-lengths of the rays emitted by cadmium in a vacuum tube were determined by Michelson's interference method and calculated from the wave-length, already known, of the red ray 0·6438472. The relative intensities of the rays and their wave-lengths are as follows.

Intensity	1	4	3	3	2
λ	0·6438472	0·6325161	0·5378128	0·5337477	0·5154655
Intensity	1	1	2	4	5
λ	0·5085832	0·4799919	0·4678153	0·4662345	0·4415702

The sixth and seventh rays are complex, but all the others are very simple, with the exception of the eighth, which is somewhat complex. The presence of air in the tube simplifies the complex rays and causes some of the simple rays, notably the third, fourth, and fifth, to disappear altogether. C. H. B.

Electrical Resistance of Crystallised Silicon. By FERNAND LE ROY (*Compt. rend.*, 1898, **126**, 244—246).—The author suggests the substitution of resistances of crystallised silicon in place of metallic resistances when electrical heating is required. Its resistance, specific heat, and emissive power are all high. It is easy to prepare sticks of pure agglomerated silicon 10 cm. long and 40 sq. mm. in sectional area, with a resistance which varies with the physical condition of the silicon, but may be as much as 200 ohms, whilst the resistance of similar rods of carbon is only 0·15 ohm, and of German silver only 0·00085 ohm. It follows that, for a given resistance, the rods of carbon must be much smaller than those of silicon, and the rods of German silver very much smaller still. The resistance of silicon diminishes as the temperature rises, and at 800° is only about 0·6 of its value at the ordinary temperature. C. H. B.

Electrical Conductivity of Dilute Solutions at Various Temperatures up to 100°. By R. Schaller (*Zeit. physikal. Chem.*, 1898, **25**, 497—524).—In order to avoid the action of water on glass at high temperatures, a platinum vessel was employed, but it was found that, in the case of acids and neutral salts, vessels made of Jena glass might be used. The measurements at 25° before and after heating were found to differ by about 3 per cent., and this difference was ascribed to changes in the electrodes, as it became considerably less after the electrodes had been used frequently at the high temperatures. The conductivity of the water employed rose from about 1×10^{-6} at 25° to about $2·6—2·8 \times 10^{-6}$ at 99°. An approximately equal temperature coefficient was obtained with solutions of potassium chloride, sodium chloride, potassium nitrate, and sodium nitrate, being about $2000-2300 \times 10^{-6}$ and increasing slightly with the temperature. For hydrochloric acid, the coefficient is much smaller, $1200—1400 \times 10^{-5}$, and decreases with rise of temperature. The migration velocities of the various ions are calculated for temperatures up to 100°, the assumption being made that the velocities of the potassium and chlorine ions are equal at all temperatures. The sodium salts of cinnamic, orthotoluic, paratoluic, benzoic, orthoiodobenzoic, metiodobenzoic, orthonitrobenzoic, metanitrobenzoic, parachlorobenzoic, and anisic acids were also examined. The molecular conductivity was found to increase with rise of temperature, but at a diminishing rate, in some cases reaching a maximum and then decreasing; the degree of dissociation however, as well as the heat of dissociation, which is calculated from the temperature coefficient, was found in each case to decrease with rise of temperature, the heat of dissociation frequently changing at the higher temperatures from a positive to a negative value. L. M. J.

Dissociation of Electrolytes as Measured by the Boiling Point Method. By Harry C. Jones and Stephen H. King (*Amer. Chem. J.*, 1897, **19**, 753—756).—The Beckmann boiling point apparatus in its improved form has been applied to the measurement of the electrolytic dissociation of solutions of potassium iodide and sodium acetate in ethylic alcohol. The dissociation of potassium iodide in alcohol is between one-third and one-fourth of that in water at the same dilution. This is just about the same ratio as exists between the dielectric constant of these two solvents. The dissociation found for sodium acetate is very low, but the authors are inclined to attribute this to slight impurity in the salt. H. C.

Electric Furnaces. By Gin and Leleux (*Compt. rend.*, 1898, **126**, 236—238).—The characteristic fall of potential of an arc striking across a given medium is due simply to the resistance of the mass of gas which lies between the electrodes resulting from the volatilisation of the material of the electrodes or of the substances subjected to the action of the arc. If this mass of gas is regarded as a cylinder with a sectional area equal to that of the electrodes, and if this cylinder is assumed to be surrounded by a perfect thermal screen, it can be shown that the temperature of the arc would increase as the square of the density of the current and the ratio of the resistivity to the specific heat per unit volume of the atmosphere of the arc, the two latter factors being themselves variable with the temperature.

When the arc is allowed to pass through a mixture such as that used in the preparation of calcium carbide, the arc forms round itself a sort of pocket, at the upper pole of which is a small crater through which carbonic oxide and the vapours of calcium oxide, calcium, and carbon escape. The volume of this cavity increases up to the point at which the heat liberated by the arc is in equilibrium with the loss of heat to the surrounding medium. After cooling, it is found that the interior of the pocket is lined with a brilliant layer of vesicular graphite, behind which is a concentric layer of crystallised calcium carbide, and behind this a layer of unaltered material. This result can be explained by assuming either that at the temperature of the arc the calcium carbide dissociated, or that part of the calcium oxide volatilised so rapidly that it escaped reduction, and an excess of carbon was left. Direct experiment shows, however, that with a sufficiently intense arc, calcium carbide is dissociated at a temperature below that at which carbon volatilises. The tension of the arc varies with the surrounding atmosphere; for example, with calcium carbide mixture when the stationary temperature is reached the tension is from 18 to 20 volts, the electrodes being 10 cm. apart, whilst with a mixture of carbon and manganese oxide the tension is only 10 volts, and the pocket formed is much larger.

C. H. B.

Conditions required for attaining Maximum Accuracy in the Determination of Specific Heat by the Method of Mixtures. By F. L. O. Wadsworth (*Amer. J. Sci.*, 1897, [iv], 4, 265—282).—From a mathematical discussion of the conditions required for attaining the maximum degree of accuracy in specific heat determinations by the method of mixtures, it appears that the greatest possible care should be taken in reading temperatures, since the errors of these readings are much greater than any others likely to be committed. The author advises, therefore, the use of a small amount of water in the calorimeter and a small calorimeter, a large mass of metal having a maximum surface for a given weight, and as high an initial temperature as can be conveniently attained. The calorimeter should be surrounded by a water jacket maintained at a constant temperature, higher than the initial temperature of the water in the calorimeter.

H. C.

Preliminary Thermochemical Study of Iron and Steel. By Edward D. Campbell and Firman Thompson (*J. Amer. Chem. Soc.*, 1897, 19, 754—766).—The authors give measurements of the heats of solution of samples of iron and steel in a slightly acid solution of potassium copper chloride. The chemical composition and heat evolved, on dissolving 1 gram of the metal examined, are given in each case. Thirty-five different samples of iron and steel were treated in this way, and the following points seem to be indicated by the results obtained.

In annealed metal, owing to the heat of formation of compounds of iron with carbon, the heat of solution diminishes as the percentage of carbon increases, until after the saturation point (eight-tenths to nine-tenths per cent.) is passed, when, owing probably to the endothermic formation of non-crystalline cementite, the heat of solution increases again, but never reaches that of pure iron. The presence of manganese, when combined with carbon in annealed metal, diminishes very markedly the heat of solution, owing to the greater stability of the compounds of manganese and carbon compared with that of the corresponding compounds of iron. If there is not sufficient carbon to combine with the manganese, or if the carbon is above the saturation point, the substitution of manganese for iron seems to increase the heat of solution slightly, owing to the higher heat of formation of manganous chloride compared with that of ferrous chloride. In the quenched metal, manganese seems to behave exactly the reverse of that in the annealed steel, the effect being to very notably increase the heat of solution, the increase being more marked the higher the temperature from which the steel is quenched. Phosphorus plays a considerable part in determining the heat of solution.

Some results obtained with copper confirm those of Osmond, that heat treatment has but slight influence on the heat of solution.

The influence of reheating, or tempering, hardened steel on its heat of solution was also investigated. The reheating was carried out either in a hydrogen or nitrogen atmosphere. The heat of solution decreases, and the apparent percentage of carbon, as indicated by the colour test, increases with the temperature to which the metal is reheated, until the critical point *Ac* is passed. The hydrogen then seems to combine with the carbon, and the heat of solution rises very markedly. When the gas used is nitrogen, the temperature being over 1000°, the nitrogen removes the carbon, part at least forming cyanogen, and the heat of solution of the metal is very much lowered. The diminution in tensile strength is almost exactly proportional to the diminution in the heat of solution. H. C.

Determinations of the Density of Small Volumes of Gases. By TH. SCHLŒSING, junr. (*Compt. rend.*, 1898, **126**, 220—223).—The author has devised an apparatus for the determination of the density of gases that are only available in small quantity. It is an adaptation of the vertical tube apparatus frequently used in the case of liquids, and consists of two tubes 1·1 to 1·6 metres long, and 2·0 to 2·5 mm. in diameter, these dimensions being selected with a view to minimise diffusion. At the bottom, the tubes are connected, by means of a three-way stopcock, with one another and with a reservoir containing mercury. At the top, each tube is bent at a right angle, and can be connected either with a U-shaped absorption bulb or with a horizontal tube, the function of which is to prevent the entrance of air into the vertical tubes. For the greater part of their length, the vertical tubes are enclosed in a wide tube, through which a current of water is passed.

Suppose the gas, G, whose density is to be determined, is lighter than carbonic anhydride, has no action on it, and is not absorbed by potassium hydroxide solution. One vertical tube, A, is completely filled with carbonic anhydride, and the other B, with the gas under examination, and communication is established between the two tubes, their upper ends being open to the air. Some of the carbonic anhydride passes into the lower part of the tube B, and drives out some of the gas G, whilst air is drawn into the upper part of A. After waiting about 10 minutes, to allow equilibrium to be established, without giving time for the gases to mix by diffusion, communication between the two tubes is cut off.

Let α and β be the surfaces at which respectively air and carbonic anhydride, and the gas G and carbonic anhydride would be in contact if they did not mix at all, h and h' the vertical distances of α and β from the centre of the open ends of the tubes, and d, d', and δ the respective densities of air, the gas G, and carbonic anhydride, in the dry state and at the particular temperature and pressure. The weights of the gas in the tubes A and B between β and the centre line of the upper apertures are the same, and $h'd' = hd + (h' - h)\delta$, for if the insides of the tubes were moistened all the gases are saturated with water vapour. Moreover, the densities of all the gases, under the conditions of the experiment, differ from their densities under standard conditions by the same factor. Hence $h'd'_0 = hd_0 + (h' - h)\delta_0$. In the case under consideration, $d = 1$ and $\delta = 1{\cdot}529$. To determine h and h', each tube is connected with an absorption bulb containing potassium hydroxide solution, and the whole of the gas from each tube is passed into the potassium hydroxide solution until the whole of the carbonic anhydride has been absorbed. The residual gases are then brought back into their respective tubes, and adjusted to atmospheric pressure. The points at which the mercury stands are α and β, and these determine h and h'. The results obtainable in this way will be discussed in a later paper. C. H. B.

Densities of Small Quantities of Gases. By TH. SCHLŒSING, junr. (*Compt. rend.*, 1898, **126**, 476—479).—The author has determined the densities, with reference to air, of several gases, by means of the apparatus previously described (preceding abstract), working with 5 to 7 c.c. of gas and using carbonic anhydride as the third gas.

	Air.	Nitrogen.	Oxygen.	Argon.	Methane.
Density found ...	1	0·967	1·105	1·376	0·559
Real density	1·000	0·967	1·105	1·376	0·558

It was found that equilibrium was attained in from 4 to 6 minutes, and with a longer time the influence of diffusion began to be recognisable. When the density is taken with successive fresh quantities of gas, allowing 2, 4, 6, 8 . . . . . . minutes for the establishment of equilibrium, the density obtained at first decreases with the time allowed, remains constant with periods of 4 to 6, or sometimes 8, minutes, and then again diminishes.

With hydrogen, diffusion is so rapid that good results cannot be obtained. The tubes used varied from 1·15 m. to 1·65 m. in height and from 1·6 mm. to 2·7 mm. in diameter. C. H. B.

Mixtures of Gases. By ANATOLE LEDUC (*Compt. rend.*, 1898, **126**, 218—220).—The author proposes to substitute for the well-known law of partial pressures, which is not in absolute agreement with the facts, the statement that *the volume occupied by a mixture of gases is equal to the sum of the volumes occupied by its constituents under the particular temperature and pressure.* In a mixture of gases, each constituent should be regarded as subject to the total pressure, and not simply to the pressure, it would itself exert if it were alone in the vessel. The volumetric composition of air calculated from the densities of oxygen and atmospheric nitrogen agrees with the actual determinations, but the composition calculated from the law of partial pressures is distinctly inaccurate. Direct experiments show that when carbonic anhydride (2 vols.) and nitrous oxide (1 vol.) are mixed there is no change in volume or pressure, whilst the old law would require an increase in pressure of 2·3 mm. On the other hand, with carbonic anhydride and sulphurous anhydride, under similar conditions, there is an increase in pressure of 1·25 mm., but this is only about one-quarter of the increase regarded by the old law. The difference between the density of argon as calculated by the author on the basis of his law of volumes, 19·80, and that determined by Rayleigh and Ramsay, 19·94, is probably due to the fact that, when nitrogen and argon are mixed, there is an increase in pressure (or volume). C. H. B.

Geissler's Densimeter. By M. LEFEBVRE (*Chem. Centr.*, 1897, ii, 402—403).—The apparatus consists of two U-tubes whose shorter, graduated limbs are joined at the top; a stop-cock inserted at the junction communicates with the air, and the bottom of each U-tube is provided with a tap. To determine the specific gravity of a liquid, the middle cock is opened, water is run into the one tube (whose graduations read from below upwards) and the given liquid into the other (graduated from above downwards) until the liquid surface in each tube stands at zero. The middle cock is then closed and water added to the tube which contains water until the surface in the longer tube reaches a certain height. From the difference of the levels of the liquids in the tubes, the specific gravity of the given liquid is easily calculated. E. W. W.

Determination of Dissociation Constants by the Increase of Solubility. By RICHARD LÖWENHERZ (*Zeit. physikal. Chem.*, 1898, **25**, 385—418).—The solubility of an acid in water is increased by the addition of small quantities of a base, and this increase being dependent on the dissociation of both base and acid, may serve as a means of determining the dissociation of the acid if that of the base is known, and *vice versâ*; the necessary equation is deduced in the paper. The availability of the method was first proved by the determination of the dissociation of aniline and paratoluidine by their addition to solutions of cinnamic and paranitrobenzoic acids. The value obtained by means of these two acids agreed satisfactorily with one another and with those of Bredig (Abstr., 1894, ii, 229), whilst the close agreement of the values obtained by the use of various concentrations indicated the possible accuracy of the method. It is available for bases of very varying degrees of dissociation, but the details of the experimental method differ according to the solubility of the compounds. The dissociation-degrees of the nitranilines were determined with the aid of paranitrobenzoic and parabromobenzoic acids; the values $4 \cdot 2 \times 10^{-12}$ and $5 \cdot 3 \times 10^{-2}$ were obtained for metanitraniline, and $1 \cdot 1 \times 10^{-12}$ and $1 \cdot 3 \times 10^{-12}$ for paranitraniline. In the case of the ortho-base, the increase of solubility of the acids employed was too small, and hydrochloric acid was therefore used, when the value $0 \cdot 015 \times 10^{-12}$ was obtained. The influence of the nitro-group in weakening the basic character of aniline is hence weakest in the meta-position, a result in accord with its influence on the acidity of benzoic acid. The dissociation of ψ-cumidine was also determined by means of parabromobenzoic acid, and the value $1 \cdot 7 \times 10^{-9}$ was obtained; the constant for paratoluidine is $2 \cdot 05 \times 10^{-10}$ so that the further entrance of methyl groups has but little effect on the basicity. L. M. J.

Apparatus for Determining the Solubility of Substances in Boiling Liquids. By HEINRICH GÖCKEL (*Chem. Centr.*, 1897, ii, 401—402; from *Forsch.-Ber. Lebensm.*, 4, 173—177).—The solvent is boiled with the substance to be dissolved in a flask which is fitted with a reflux condenser and contains a small filter-tube in which cotton-wool is placed; during the boiling, this tube serves to conduct a current of air whereby the liquid is stirred and also prevented from entering the filter. A portion of the saturated solution may be withdrawn from the flask for examination, by forcing the liquid through the filter into a second flask also fitted with a condenser, deposition of the substance in transit being prevented by surrounding the connecting tube with liquid maintained at a temperature 1° or 2° higher than the boiling point of the solvent.

By means of this apparatus, the author has obtained the following data for the solubility of caffeine in various liquids in each case at 18° and at the boiling point respectively. One part of caffeine dissolves in 839 and 339 parts of ether; in 109·8 and 18·9 of benzene; in 8·5 and 6·4 of chloroform; in 1123 and 142·4 of carbon tetrachloride. Theobromine is quite insoluble in carbon tetrachloride or anhydrous ether at 18°, but at the boiling point 1 part is dissolved in 4703 and 3125 parts of these liquids respectively. E. W. W.

Combination and Substitution. By F. WALD (*Zeit. physikal. Chem.*, 1898, 25, 525—535.)—A continuation of the author's previous theoretical papers on the application of Gibbs' phase law to chemical processes (this vol., ii, 159.)

Mass Action and the Phase Law. Function of the Solvent in Chemical Reactions. By BASIL B. KURILOFF (*Zeit. physikal. Chem.*, 1898, 25, 419—440).—The partition ratio of acetic acid dissolved in water and benzene is apparently not constant, being a function of the concentration, but if the dissociation is allowed for and the partition ratio calculated for the undissociated molecules only, a constant value is obtained. Hence, if a system AB, dissociable into A and B be dissolved in liquid (1) and c_1, c_2, c_3, be the concentrations of the complex and component groups, $K_1c_1 = c_2c_3$ where K_1 is the velocity constant of the reaction; similarly, in a second solvent, (2) the equation $K'_1c'_1 = c'_2c'_3$ obtains. If k_1, k_2, k_3 be the partition ratios for the three molecular groups, it follows that $k_1 = k_2k_3K'_1/K_1$, and as the partition ratio is equal to the ratio of the solubilities in the two solvents, the solubility in one may be calculated if the remaining constants are known. The author has tested this deduction experimentally in the case of solutions of β-naphthol picrate in benzene and in water. The reaction constant for the equation β-naphthol picrate $\rightleftarrows$ β-naphthol + picric acid was found to be 4466 in aqueous solution at 29·5° and 3607 at 12·5°; in benzene solution, the constant is 18220 and the solubility was found to be 0·0308 gram-molecules per litre. In determining the partition ratio of the picric acid, the dissociation in water was allowed for and the value 39 obtained, whilst for β-naphthol the ratio was about 67, all constants being found for 29°. It hence follows that the solubility of the β-naphthol picrate in water is given by the expression $18220 \times 0{\cdot}0308/4466 \times 39 \times 67$, that is, 0·000047 mol. per litre. The experimental determination of the solubility of the undissociated picrate is difficult, and the author attempted to obtain it from (1) the changes in the composition of the solution in equilibrium with β-naphthol picrate by the addition of β-naphthol or picric acid, (2) the difference in the solubility of β-naphthol by the addition of the picrate. The results are, however, not entirely free from doubt, and indicated a solubility of the undissociated compound varying from 0·00007 to 0·00008. The 29° isotherms for the aqueous and benzene solutions are given, and it is seen that if these be taken for undissociated molecules only, the curves for the two solutions become very similar and almost identical in form. L. M. J.

Influence of the Medium on the Velocity of Reaction in Gaseous Systems. By Ernst Cohen (*Zeit. physikal. Chem.*, 1898, **25**, 483—496).—It has been shown by Menschutkin and by Carrara that the velocity of reaction in liquid systems is profoundly modified by the use of different solvents (Abstr., 1894, ii, 310), and the effect varies with different reactions, the velocity of reaction of triethylamine and ethylic iodide being greater in acetone than in ethylic or methylic alcohol, whilst that of diethylic sulphide and ethylic iodide is far greater in the alcoholic than in the acetone solution. The author, therefore, investigated the effect of indifferent gases on a gaseous reaction velocity, and the decomposition of arsenic trihydride was chosen for the purpose, the author having previously shown that the velocity of reaction becomes constant in this case as soon as the walls of the containing vessel are completely coated with arsenic (Abstr., 1896, ii, 593). The apparatus employed was essentially identical with that employed originally by van't Hoff and Kooy, and the velocity was determined for arsenic trihydride alone, and for mixtures of this gas with hydrogen and with nitrogen, but neither gas had any effect on the velocity of reaction, a result predicted by Nernst (*Theor. Chem.*), It was also shown that the velocity of the reaction is very greatly reduced if the walls of the vessel are thoroughly cleaned by 'aqua regia,' being reduced to about one-tenth of the original value.

L. M. J.

NOTE.—It may be noted that the influence of an admixed gas is not at all comparable with that of a solvent in liquid systems, as in Menschutkin's and Carrara's experiment, since the solvents have varying dissolving and ionising effects on the various reacting compounds, and are hence not indifferent substances. L. M. J.

Speed of Reduction of Ferric Alum by Sugar. By JOHN H. LONG (*J. Amer. Chem. Soc.*, 1897, **19**, 683—698).—In a mixture of ferric alum and sugar, inversion of the sugar and reduction of the iron salt take place rapidly on warming, or even on standing in bright sunlight through several warm days. The speed of the reduction was measured by the determination of resistances from time to time, the results being compared with the resistances found from known mixtures of acid, ferric and ferrous salts, and ammonium sulphate. The speed is found to be an accelerated one, the cause of the acceleration being the sulphuric acid liberated as the reduction advances. If A represents the ferric salt present at the beginning of the experiment, and x that reduced at the time t, and B is the amount of sugar, the speed is given by the equation $dx/dt = K(B+x)(A-x)$. H. C.

Equilibrium in the System, Water, Ether, and Ethylenic Cyanide. By FRANS A. H SCHREINEMAKERS. (*Zeit. physikal. Chem.*, 1898, **25**, 543—567).—The equilibrium between water and the other components had been previously determined (Abstr., 1897, ii, 483; this vol., ii, 156) and a few points on the equilibrium curve of the cyanide and ether were first obtained. In the case of the system with the three components, a quintuple point exists at 4·5°, where ice, solid ethylenic cyanide, and two liquid phases co-exist, or, representing liquids in which water, ether, and the cyanide respectively predominate, by L_w, L_e, and L_c, the equilibrium at this quintuple point is that of ice + cyanide + L_e + L_w. With rise of temperature, the change, ice + cyanide + $L_e \rightarrow L_w$ occurs, and at the point four, equilibrium fields meet, namely, those of ice + cyanide + L_e; ice + cyanide + L_w; ice + L_e + L_w and cyanide + L_e + L_w, the latter existing at temperatures above − 4·5°, the first at temperatures below − 4·5°. The further changes of these equilibrium systems were investigated, and it was found that, in the case of the field, cyanide + L_e + L_w, a new quintuple point occurs at the temperature 1—2°, where, owing to the liquefaction of the solid cyanide, the equilibrium is that of the system, solid cyanide + L_e + L_w + L_c. The composition of each of the three liquid phases was determined; $L_e = 7·5$ mols. water + 87·5 mols. ether + 4·8 mols. ethylenic cyanide; $L_w = 95·1$ mols. water + 3·1 mols. ether + 1·6 mols. ethylenic cyanide; $L_c = 27·9$ mols. water + 16·4 mols. ether + 55·6 mols. ethylenic cyanide. On heating, the change $N + L_e + L_w \rightarrow L_c$ occurs; four equilibrium fields occur, and these were further investigated. To trace the further equilibrium of the three liquid phases, various mixtures were prepared and heated, and it was found that at 56·5 the phases L_w and L_c become identical, and two liquid phases hence result. A number of diagrams of the isothermals at various temperatures are given, and are necessary for the discussion of the experimental results. L. M. J.

Decomposition of Triglycerides with Dilute Acids. By Adolf C. Geitel (*J. pr. Chem.*, 1898, **57**, 113—131. Compare Abstr., 1897, i, 546).—The velocities of hydrolysis of mono-, di-, and tri-acetin with dilute hydrochloric acid have been determined, and are found to be in the proportions 1 : 2 : 3. Mathematical equations are given which hold good, not only for the decomposition of the triglycerides, but also in general for all bimolecular reactions, with measurable velocity, leading to the formation or decomposition of tri-derivatives.

The paper is principally a theoretical one of a physico-chemical nature. A. W. C.

Dependence on Temperature of the Number of Crystallisation Nuclei which form in Supercooled Liquids. By Gustav Tammann (*Zeit. physikal. Chem.*, 1898, **25**, 441—479).—If a melted solid is strongly supercooled, and then kept at a higher temperature below its melting point, crystallisation proceeds from a number of nuclei, and the author endeavoured to determine the effect of the supercooling and the time of exposure on the number of nuclei. For the quantative experiments, betol and piperine were chiefly employed, but experiments were also performed with allylthiocarbamide, chloralurethane, cinchonidine, dulcitol, mannitol, narcotine, *d*-camphoric acid, resorcinol, santonin, and vanillin. The number of crystallisation points is very small in proportion to the number of molecules present, not exceeding 1000 per minute per cubic mm., and increases with increased supercooling until it attains a maximum, then decreases. The temperature of this maximum always occurs in the temperature interval in which the velocity of crystallisation decreases with fall of temperature, and is only very slightly altered by the presence of foreign substances, although the actual number of the points of crystallisation may be greatly changed, in either direction, by the presence of small quantities of either soluble or insoluble compounds. Various modifications of crystalline aggregates may occur, each having its own maximum, that of the more stable modification being usually lower than that of the less stable form, and the addition of a foreign substance frequently causes the disappearance of one form and increase of the other. About 150 compounds were also qualitatively examined, and it was found that about one-third of these could by very speedy supercooling be obtained as glassy masses, and the author considers it probable that all compounds could be so obtained by sufficiently rapid cooling.

L. M. J.

Velocity of Crystallisation. By Friedrich W. Küster (*Zeit. physikal. Chem.*, 1898, **25**, 480—482).—The explanation of the crystallisation of overcooled liquids offered by Tammann (Abstr., 1897, ii, 444) indicates constancy of the velocity of solidification, and although this obtains if the overcooling is sufficiently great, yet it is at first approximately proportional to the overcooling, and the author therefore offers an explanation more in accord with experimental facts. L. M. J.

Convenient Gas Generator. By Theodore W. Richards (*Amer. Chem. J.*, 1898, **20**, 189—195).—The principle adopted by the author is to remove the exhausted solution from the lower part of the generator by taking advantage of its increased density, and to supply fresh liquid by means of a tube or perforations situated in the upper part of the generator. Several modifications of the apparatus are described, the advantages claimed being that the fresh material is kept uncontaminated with that which has been exhausted, and that variations of pressure are minimised. A similar device is made use of for rapidly dissolving crystals; the "dissolver" in which the crystals are placed consists of a cylindrical funnel, the sides of which are perforated at the top; it is completely immersed in the solvent, contained in a deep, narrow cylinder, and in the bottom of the latter the heavy liquid formed by the dissolved salt collects.

W. A. D.

Inorganic Chemistry.

Composition of Air in Various Places: Densities of Gases. By Anatole Leduc (*Compt. rend.*, 1898, **126**, 413—416).—The author has determined the composition of air from various localities by his method of weighing the air and calculating the proportions of oxygen and nitrogen from their densities. The percentage of oxygen by weight was as follows:—Paris 23·20; Nice, Nimes, Algiers, in summer, 23·23; near Dieppe, July, 23·16, April, 23·07; Belgian frontier, summer, 23·17, winter, 23·09; Alps (2060 metres), violent descending wind in October, 23·05, ascending breeze on following day, 23·23; Puy de Dôme, November, calm, 23·17, November, with strong south-west wind, 23·23.

The author considers that the air of London is somewhat less rich in oxygen than the air of Paris, and that this explains the fact that Lord Rayleigh's densities of gases as compared with air are always somewhat higher than his, whereas when oxygen is taken as the unit both sets of results agree. On this assumption, London air contains 23·1 per cent. by weight of oxygen.

	Density, air = 1.		Density, oxygen = 1.	
	Rayleigh.	Leduc.	Rayleigh.	Leduc.
Oxygen	1·10535	1·10523	1	1
Atmospheric nitrogen	0·97209	0·97203	0·87944	0·87948
Chemical nitrogen	0·96737	0·96717	0·87507	0·87508
Carbonic oxide	0·96716	0·96702	0·87498	0·87495
Carbonic anhydride	1·52909	1·52874	1·3833	1·3832

Lord Rayleigh's number for carbonic anhydride was corrected for compressibility, the determinations having been made at a pressure above normal, and his value for chemical nitrogen was recalculated, leaving out the results obtained with nitrogen prepared by decomposing nitogen peroxide.

C. H. B.

Hypertitanates and Hyperborates. By PETR G. MELIKOFF and L. PISSARJEWSKY (*Ber.*, 1898, **31**, 678—680).—Sodium hyperborate, $NaBO_3 + 4H_2O$, is readily obtained when a saturated solution of borax containing an equivalent quantity of sodium hydroxide is treated with an excess of hydrogen peroxide (double the amount calculated for $NaBO_3$); after some time, large, transparent crystals of the salt separate. It is stable at the ordinary temperature, and dissolves in water without undergoing decomposition, but its aqueous solution, on warming, evolves oxygen. 100 grams of water dissolve 1·17 grams of the salt.

When a solution of borax and alkali is treated with half the amount of hydrogen peroxide mentioned above, kept at 40°, then cooled and treated with alcohol previously cooled to −10°, a white, crystalline, unstable compound is obtained; it is readily soluble in water, but undergoes decomposition evolving oxygen and yielding crystals of the hyperborate, $NaBO_3 + 4H_2O$.

Potassium peroxide hypertitanate, $K_2O_2,TiO_3,K_2O_4 + 10H_2O$, is obtained when well-cooled hydrogen peroxide and the requisite quantity of potassium hydroxide are added to pertitanic anhydride. On the addition of well-cooled alcohol, minute crystals are obtained, which may be washed with cooled alcohol and ether, and pressed on a cold porous plate. They are stable at 0°, but deliquesce at ordinary temperatures and give up oxygen.

Sodium peroxide hypertitanate, $(Na_2O_2)_4,Ti_2O_7 + 10H_2O$, crystallises in small, colourless prisms; it does not liberate iodine from potassium iodide. When dissolved in water, it evolves oxygen, and when placed over sulphuric acid it loses both water and oxygen. J. J. S.

Reduction, Electrolysis, and Photolysis of Carbonic Anhydride. By A. BACH (*Compt. rend.*, 1898, **126**, 479—481).—Lieben has shown that when carbonic anhydride is reduced by sodium amalgam in an alkaline solution, formic acid is the sole product. The author finds that when carbonic anhydride in aqueous solution is reduced by means of hydrogen occluded in palladium, some formaldehyde is also produced. In the electrolysis of carbonic acid, the chemical changes are represented by the equation $3H_2CO_3 = 2CO_3 + 2H_2O + CH_2O = 2H_2CO_3 + O_2 + CH_2O$, and the author has shown (Abstr., 1893, 483) that, under the influence of sunlight, the acid decomposes thus, $3H_2CO_3 = 2H_2CO_4 + CH_2O = 2H_2CO_3 + O_2 + CH_2O$. Assuming that in the electrolysis the acid is reduced by the liberated hydrogen, the decompositions by electrolysis and photolysis are identical, for it is obvious that the group $CO_3 + H_2O$ is equivalent to the percarbonic acid H_2CO_4, but it remains uncertain whether the solar radiations merely act in the same way as electricity or are transformed into electricity. C. H. B.

Conditions of Formation of Carbides of the Alkali and Alkaline-Earth Metals and of Magnesium. By HENRI MOISSAN (*Compt. rend.*, 1898, **126**, 302—308).—Potassium and sodium carbides are obtained in very small quantities only by the action of the electric arc on mixtures of the respective metals and their carbonates, even when the intensity of the arc is low. Both carbides are, in fact, dissociated at a temperature considerably lower than that of the arc. Lithium carbide is more stable, but yet is decomposed somewhat readily; calcium carbide can be completely decomposed, even in presence of excess of carbon, by an arc from a current of 1200 ampères and 60 volts without volatilising the carbon; magnesium carbide is decomposed by the arc from a current of 600 ampères and 60 volts, and, like the carbides of sodium and potassium, cannot be prepared in the electric furnace.

Potassium is slowly attacked by acetylene at the ordinary temperature and pressure, the action in time being complete; hydrogen is liberated, and the compound C_2HK is formed. Sodium behaves similarly, but the action of acetylene gas at the ordinary temperature and pressure is extremely slow. With liquid acetylene at the ordinary temperature, the action is much more rapid, and, after many days, is complete. The compressed gas behaves similarly, and the rate of action seems to be a function of the pressure. Under ordinary pressure, the action of the gas on the metal is very distinct at 50°, and at 70° small fragments of sodium are completely converted into the compound C_2HNa after about 15 days.

The compounds C_2HK and C_2HNa are white solids, which are readily decomposed by water, with liberation of acetylene. When heated, they give off acetylene, and are converted into the carbides, C_2K_2 and C_2Na_2, which decompose into carbon and hydrogen if heated to redness in a vacuum. C. H. B.

Decomposition of Strontium Thiosulphate and Sulphite by Heat, and Production of Phosphorescent Strontium Sulphide.

By José R. Mourelo (*Compt. rend.*, 1898, **126**, 420—423).—Strontium thiosulphate begins to decompose at a red heat, and if kept at bright redness for 3 hours it is completely converted into sulphate, which is very slightly phosphorescent. At a somewhat lower temperature, decomposition takes place in accordance with the equation $4SrS_2O_3 = SrS + S_4 + 3SrSO_4$, and the product contains strontium sulphide, 15·02; sulphur, 16·12; strontium sulphate, 68·45 per cent. It shows a yellowish-green phosphorescence which has its maximum intensity when the product has the composition indicated. Strontium sulphite behaves similarly, and yields a mixture of sulphide and sulphate, which shows a maximum intensity of phosphorescence when it has the composition, sulphide 14·05, sulphate 85·94 per cent.

In these cases, the phosphorescent material is mixed with a large proportion of a non-phosphorescent compound, and possibly the latter has the same function as the inert substances in the cases investigated by Lecoq de Boisbaudran (Abstr., 1890, 435). The intensity of the phosphorescence of the strontium sulphide mixtures is not materially affected by the addition of a considerable proportion of sodium chloride.

The products from both the sulphite and the thiosulphate alter somewhat rapidly when exposed to air owing to the oxidation of the finely divided strontium sulphide. C. H. B.

Atomic Weight of Zinc. By HARMON N. MORSE and H. B. ARBUCKLE (*Amer. Chem. J.*, 1898, **20**, 195—202).—In view of the observation of Richards and Rogers (Abstr., 1894, ii, 45), that zinc oxide prepared by igniting the nitrate always retains nitrogen and oxygen, even when strongly heated, the authors have repeated the experiments of Morse and Burton (Abstr., 1888, 1247) on the atomic weight of zinc, taking into account the weight of both oxygen and nitrogen which remains occluded. This was estimated by measuring the gas evolved on dissolving the zinc oxide formed in each experiment in dilute sulphuric acid from which all gases had been removed by exposure for several days in a vacuum. The oxygen was determined by explosion with hydrogen; the gas remaining was found to contain free nitrogen only.

None of the nitrogen appears to be retained by the zinc oxide as nitride, and the occlusion of gases appears to be solely due to physical causes; the authors cannot confirm the statement of Richards and Rogers, that, on heating, the imprisoned oxygen escapes more readily than the nitrogen.

The average of eight experiments, ranging from 65·437 to 65·489 gives 65·457 as the corrected value for the atomic weight of zinc, that of oxygen being taken as 16. W. A. D.

Colour of Amorphous Mercurous Iodide. By MAURICE FRANÇOIS (*J. Pharm.*, 1897, [vi], **6**, 529—533).—Mercurous iodide quite free from mercuric iodide and also from metallic mercury may readily be obtained by the following method:—125 grams of mercurous nitrate is dissolved in 2 litres of water to which 20 c.c. of nitric acid has been added. A solution of 50 grams of potassium iodide in 100 c.c. of distilled water is run in drop by drop with constant stirring; the mixture is then shaken for some 15 minutes, and the precipitate, which at first has a greenish-yellow appearance, changes to clear yellow. The precipitate is left in contact with the mother liquor for 24 hours in the dark, is then washed some 12 times by decantation in the dark, 2 litres of water being used for each washing, and is finally transferred to a filter paper and dried at 50°. As thus obtained, mercurous iodide is of a pure yellow colour with no shade of green. The ordinary green iodide consists of a mixture of mercurous iodide with metallic mercury. J. J. S.

Action of Hydrogen Arsenide on Mercuric Chloride. By ALFRED PARTHEIL and E. AMORT (*Ber.*, 1898, **31**, 594—595).—This reaction, in aqueous or alcoholic solution, is known to give rise to the formation of the yellow compound $AsH(HgCl)_2$ and the brown $As(HgCl)_3$ in succession; attempts to prepare the compound $AsH_2 \cdot HgCl$ have been unsuccessful, but by continuing to pass hydrogen arsenide into the alcoholic solution, a black precipitate of the composition As_2Hg_3 was obtained. C. F. B.

Constitution of Inorganic Compounds. XII. Anhydro-oxycobaltammine and Oxycobaltammine Salts. By ALFRED WERNER and ALB. MYLIUS (*Zeit. anorg. Chem.*, 1898, **16**, 245—267). —*Anhydroxycobaltammine salts.*—The *nitrate*, $Co_2O_2(NH_3)_{10}(NO_3)_5$, is obtained as follows:—50 grams of cobalt carbonate, dissolved in the necessary quantity of dilute nitric acid, is mixed with 200 grams of ammonium nitrate, and filtered, mixed with 600 c.c. of ammonia (20 per cent.) and treated with a current of air for 36 to 48 hours until the solution no longer smells strongly of ammonia. The black solution, which contains crystals of Frémy's oxycobaltammine nitrate, is evaporated to a magma in a current of air, mixed with nitric acid, and the salt separated by filtration, and washed with cold dilute nitric acid until the filtrate is colourless. The anhydroxycobaltammine nitrate is completely insoluble in dilute nitric acid, whereas it is quickly decomposed by pure water. It crystallises from hot dilute nitric acid (20 c.c. acid to 1000 c.c. water) in black, lustrous needles. The *chloride*, with $1H_2O$, obtained by triturating the nitrate two or three times with cold concentrated hydrochloric acid, crystallises from hot dilute hydrochloric acid in long, green needles.

Anhydroxycobaltammine nitrate, when treated with ammonia, yields a brownish-red solution, from which hexamminecobalt nitrate separates on cooling; the filtrate, when treated in the cold with concentrated hydrochloric acid, at first yields a brownish-red precipitate of chloropentamminecobalt chloride, and the filtrate from this, after about 3 hours, deposits a small quantity of a black, insoluble chloride which has not been further examined.

Anhydroxycobaltammine nitrate, when triturated with a cold solution of potassium cyanide, yields a *cyanide* of the composition $Co_2N_{10}C_6H_{21}O_3$, with evolution of ammonia and hydrogen cyanide. This cyanide is easily soluble in excess of potassium cyanide, and cannot be isolated from such a solution; it is necessary, therefore, to take care that only just sufficient potassium cyanide is used in preparing it. The product is cautiously washed with water, very dilute sulphuric acid, and ammonia until the filtrate is colourless, then dissolved in a concentrated solution of potassium thiocyanate, and precipitated with absolute alcohol. It is a cherry-red powder, and when warmed with silver nitrate solution, yields hexamminecobalt nitrate and cobalt silver cyanide.

When anhydroxycobaltammine nitrate is dissolved in an excess of sulphurous acid, a red solution is obtained, and this, when evaporated in a vacuum, yields red crystals of aquopentamminecobalt nitrate. If heated with concentrated hydrochloric acid, 48 per cent. of the anhydroxycobaltammine nitrate is converted into chloropentamminecobalt chloride and 52 per cent. into cobalt sulphate (after treating the filtrate from the chloride with sulphuric acid). When heated with nitric acid, aquopentamminecobalt nitrate is obtained.

Oxycobaltammine Salts.—When oxycobaltammine nitrate is dissolved in an excess of sulphurous acid, a red solution is obtained, which, if heated with concentrated hydrochloric acid, yields only a small quantity of chloropentamminecobalt chloride, about 5 per cent. of the nitrate being converted into this compound. The filtrate from the chloropentamminecobalt chloride, after evaporation and treatment with sulphuric acid, yields cobalt sulphate corresponding with about 93 per cent. of the oxycobaltammine nitrate. This reaction with sulphurous acid, therefore, provides an easy means of distinction between anhydroxycobaltammine salts and oxycobaltammine salts.

The author was unable to obtain roseocobaltpentammine chloride, as described by Vortmann, by heating oxycobaltammine nitrate at 110°. Oxycobaltammine nitrate is prepared as follows. Cobalt nitrate (200 grams) is dissolved in water (250 grams), the boiling solution poured into ammonia (850 grams, sp. gr. = 0·927), and the mixture heated for about 5 minutes; when cold, the mixture is filtered and treated with a slow current of air as long as a thick, crystalline precipitate is formed. The crystals of the oxycobaltammine nitrate are collected, washed with concentrated ammonia and alcohol, and dried by pressing between filter paper. After heating at 110° until the weight is constant, the product is treated with a small quantity of water, and the brown filtrate mixed with concentrated hydrochloric acid; after a time, a brown precipitate is obtained, consisting of a mixture of melanocobalt chloride, hexamminecobalt chloride, and aquopentamminecobalt chloride. The melanocobalt chloride, which is formed in small quantities only, remains undissolved when the mixture is treated with water. The solution containing the other two salts is boiled with hydrochloric acid, when the chloropentammine chloride is precipitated from the hot solution, and the hexammine chloride separates on cooling. This operation must be repeated several times in order to effect a complete separation. When the brown aqueous solution obtained from the product from the oxycobaltammine nitrate, after heating at 110°, is treated with nitric instead of with hydrochloric acid, hexamminecobalt nitrate is obtained, and on adding hydrochloric acid to the filtrate from this salt, chloropentamminecobalt chloride is precipitated. E. C. R.

Sodium Sulphochromite [Thiochromite]. By R. Schneider (*J. pr. chem.*, 1898, **57**, 208).—The author (this vol., ii, 229) omitted to mention Gröger's prior preparation of sodium thiochromite (*Wien. Acad.*, 1881, **83**, 749); the salt, however, was described in the red, amorphous condition, and not in the crystalline form.

A. W. C.

Atomic Weight of Tungsten. By Willett L. Hardin (*J. Amer. Chem. Soc.*, 1897, **19**, 657—676).—The author discusses the results obtained by others for the atomic weight of tungsten, and emphasises their lack of concordance; it is pointed out that even amongst the results obtained by the same experimenter serious deviations exist. The method usually adopted has been to reduce the trioxide to the metal, and subsequently to reoxidise this by ignition; the author now describes over 60 determinations by the same method. The tungsten trioxide employed was prepared by strongly igniting ammonium tungstate obtained from wolframite from Zinnwald, Bohemia, which had been carefully purified and freed from molybdenum; the reduction was effected at a very high temperature by means of purified hydrogen. The maximum deviation of the first four results by reduction in a hard glass tube was 0·35, whilst the mean value of the atomic weight was 184·10 ($O = 16$); in a porcelain tube the maximum difference was 0·28, and the atomic weight 183·84. On reoxidising, much higher results were obtained; the mean of six results gave 184·77 for the atomic weight, with a deviation of 0·85. The oxide obtained in these experiments was then reduced, a maximum deviation of 1·03 being found in eight experiments, which gave a mean of 184·40 for the atomic weight; on reoxidation, a variation of 0·64 was found in three experiments.

In the later experiments, the hydrogen used in the reduction was carefully freed from air, and the metal allowed to cool in a vacuum; a variation of 0·7 was, however, found in seven results, which gave a mean value of 184·01 for the atomic weight; and the values obtained by weighing the water formed in the reduction were equally discordant. Eight reductions of the trioxide obtained from New Zealand scheelite gave a mean of 183·74, with a maximum deviation of 0·20; on oxidation, the results varied by 0·45, and gave a mean of 183·94. Material obtained from Connecticut wolframite gave means of 183·64 and 184·18 in three experiments by reduction and oxidation respectively; that obtained from Colorado hübnerite and Bohemian scheelite gave as the mean of two experiments with each, by reduction and oxidation, 183·92, 183·99, 183·76, and 184·12.

From the author's investigations it appears that tungsten attacks the vessels, either porcelain or platinum, in which the determinations are made, that tungsten trioxide is either slightly volatile or is mechanically carried off by the hydrogen during reduction; and that it contains appreciable quantities of nitrogen and, probably, hydrogen. Hence, taking into account also the varying nature of his results, the author concludes that the method employed must be considered unsatisfactory. W. A. D.

The Salts of Pertungstic Acid and Permolybdic Acid. By PETR G. MELIKOFF and L. PISSARJEWSKY (*Ber.*, 1898, **31**, 632—636).—The salts described were obtained by adding cooled hydrogen peroxide and aqueous soda or potash to a cooled solution of a pertungstate or permolybdate, precipitating with alcohol at $-12°$, and drying the resulting salt in the air. When sodium pertungstate (1 mol.) is treated with soda (3 mols.) and excess of hydrogen peroxide, a yellow salt is obtained of the composition $Na_2O_2,WO_4,H_2O_2+(Na_2O_2)_2WO_4+7H_2O$. On prolonged exposure to the air, it loses oxygen and water, and at the same time becomes white. Water produces a vigorous evolution of oxygen, and the solution formed contains hydrogen peroxide. When only half the amount of soda is taken and a large excess of hydrogen peroxide employed, an unstable *salt*, Na_2O_2,WO_4,H_2O_2, is obtained, which explodes feebly when heated. The salt produced by the action of potash and hydrogen peroxide on potassium pertungstate has the formula K_2O_4,WO_4,H_2O, and explodes when rubbed or heated to 80°.

Potassium permolybdate reacts with potash and hydrogen peroxide to form a *salt* of the composition K_2O_2,MoO_4,H_2O_2, which is a brick-red mass, and explodes spontaneously when preserved in quantity; it loses oxygen and becomes paler when exposed to the air, and evolves oxygen when treated with water. The *sodium* salt is precipitated as a yellow oil, which decomposes even at $-10°$, and has not been analysed.

It appears from the foregoing that salts of this kind are less stable as the atomic weight of the metal from which they are produced decreases, the salts of permolybdic acid being less stable than those of pertungstic acid, and these again less stable than those of peruranic acid. A. H.

Action of Iodine on Solutions of Stannous Chloride. By Stewart W. Young and Maxwell Adams (*J. Amer. Chem. Soc.*, 1897, 19, 515—525).—On adding a concentrated solution of stannous chloride (2 mols.) containing hydrochloric acid to iodine (2 mols.), the latter dissolves, and orange-coloured crystals separate, which consist principally of stannic iodide; they contain, however, about 1·25 per cent. of chlorine, which is completely removed on recrystallisation from acetic acid or carbon bisulphide. If an excess of stannous chloride is employed, and the mixture heated with just sufficient water to dissolve the crystals that first separate, orange-red needles are obtained, which consist of stannous iodide contaminated by stannous chloride. The change is, however, not represented quantitatively by the equation $2SnCl_2 + I_2 = SnI_2 + SnCl_4$; when the proportions are those required by this equation, crystals separate which contain about 5 per cent. of stannous chloride; the latter is present in a still greater proportion when a larger excess of stannous chloride is employed. In such cases, red crystals first separate, but on standing, light-yellow patches of needles are also formed, the composition of which varies; they appear to contain an amount of stannous chloride roughly proportional to the excess of the chloride employed in their preparation, and are probably isomorphous mixtures of stannous iodide and chloride. The amount of the latter varies from 34 to 43 per cent; and the authors consider that the stannous chloriodide, SnICl, described by Henry (*Phil. Trans.*, 1843, 363), is not a definite compound, but an accidental mixture of stannous chloride and iodide in equivalent proportions.

W. A. D.

Products from an old Cornish Tin Furnace. By William P. Headden (*Proc. Colorado Sci. Soc.*, 1897, Nov. 6; and *Amer. J. Sci.*, 1898, [iv], 5, 93—96).—The following crystallised products were obtained from the hearth of an old furnace which had been in use for over 60 years at the Trethellan Tin Works, Truro. The usual Cornish tin ores smelted carried some cobaltiferous mispickel. Most of the crystals are intimately associated with metallic tin.

Stannous Sulphide.—Black, monosymmetric crystals with strong metallic lustre. Iron replaces a little of the tin in the formula SnS.

Iron Arsenide (FeAs).—Dark steel-grey, orthorhombic crystals resembling löllingite in form. Sp. gr. = 7·94.

Iron Arsenide with Stannous Sulphide (FeAs,SnS).—Black, shining, monosymmetric plates, with the same crystal forms as the stannous sulphide mentioned above. In this, and in the iron arsenide, a little cobalt replaces iron.

Tin Arsenide (Sn_6As).—Bright crystals, of a greyish tin-white colour, in the form of six-sided plates. It is soluble in hydrochloric acid with evolution of hydrogen arsenide.

Stannic Oxide.—This, which has been produced by the oxidation of metallic tin, shows the structure of "wood-tin." L. J. S.

Incandescent Gas Mantles of Commerce. By ERNST HINTZ (*Zeit. anal. Chem.*, 1898, **37**, 94—111).—The incandescent mantles in use at the present time consist almost invariably of thoria and of ceria (0·45—2 per cent.), with traces of lime, magnesia, and frequently small quantities of neodymia, yttria, and zirconia. The greatest power of emitting light is exhibited by a mixture of 99 parts of thoria and 1 part of ceria, the emissive power of this mixture being fully ten times as great as that of thoria alone. The substitution of any other of the above rare earths for the ceria tends rather to diminish than to increase the emissive power of thoria, and when present simultaneously with ceria in proportions up to 1 per cent., they in no wise increase the luminous effect. The same is the case with lime (0·5 per cent.), which, moreover, renders the mantles very fragile.

The cerium present may be estimated volumetrically by G. von Knorre's process (*Zeit. angw. Chem.*, 1897, 658, 717), which consists in oxidising the cerium to ceric sulphate by heating with ammonium persulphate and sulphuric acid, then adding a known excess of hydrogen peroxide, by which the ceric salt is reduced to cerous sulphate, and estimating the excess of peroxide by potassium permanganate. A shortened method for estimating the other constituents is also described. M. J. S.

Separation of Thorium from Cerite Metals. By GRÉGOIRE N. WYROUBOFF and AUGUSTE V. L. VERNEUIL (*Compt. rend.*, 1898, **126**, 340—343).—In order to remove thorium from cerium compounds, the latter are reduced to the cerous state, mixed with a small quantity of phosphoric acid, evaporated to a pasty consistency, treated with water, and filtered. All the thorium remains in the precipitate, mixed with some cerium.

To obtain thorium free from cerium, the solution of the nitrates is mixed with an excess of ammonium carbonate, and a small quantity of ammonium hydroxide; all the thorium remains in solution whilst the greater part of the other metals is precipitated. The solution is neutralised as exactly as possible with nitric acid, mixed with excess of hydrogen peroxide, and heated to 60°; all the thorium is precipitated, and if the precipitate is dissolved in nitric acid, evaporated to dryness, redissolved in water, and the treatment with hydrogen peroxide repeated, very pure thorium is obtained. In presence of large quantities of cerite metals, three or four precipitations may be necessary.

The formation of this compound, $Th_4O_7N_2O_5$, by the action of hydrogen peroxide constitutes a delicate and characteristic test for thorium, and can be used for its quantitative estimation. The oxynitrate cannot, however, be heated or dissolved in acids without loss, and the following method is recommended. The solution of nitrates containing not more than 0·5 gram of oxide is evaporated to dryness, mixed with 100 c.c. of water and 10 c.c. of hydrogen peroxide, heated for a short time, and filtered. The precipitate, after washing, is transferred to a flask and dissolved in hot water containing ammonium iodide and hydrochloric acid, the solution is precipitated with ammonium hydroxide, and the precipitate dried and heated. If the precipitate of oxynitrate is not white, it must be redissolved in nitric acid, evaporated to dryness, and the process repeated. C. H. B.

Pervanadates. By ANTON SCHEUER (*Zeit. anorg. Chem.*, 1898, **16**, 284—304). *Barium pervanadate*, $Ba(VO_4)_2$, is obtained as an amorphous, yellow precipitate on adding a solution of barium chloride to a saturated solution of ammonium metavanadate in 30 to 33 per cent. hydrogen peroxide solution, which must be free from sulphuric acid. The product is washed with dilute hydrogen peroxide and dried at the ordinary temperature over calcium chloride. The *potassium* salt, KVO_4 is obtained by dissolving potassium metavanadate in a solution of hydrogen peroxide acidified with sulphuric acid, and is precipitated from the solution as a microcrystalline precipitate by the addition of alcohol; the *sodium* salt, prepared in a similar manner, is very unstable, and cannot be dried without decomposition. The *ammonium, lithium, strontium, calcium, lead, silver*, and *cadmium* salts are also described; some are amorphous, and others microcrystalline salts of a beautiful bright yellow to deep orange colour.

The author was unable to obtain the corresponding salts of magnesium, aluminium, manganese, cobalt, nickel, or copper.

The *acid* itself cannot be obtained in a pure state; it is formed on heating ammonium metavanadate, dissolving the brown vanadic acid thus obtained in hydrogen peroxide solution, and evaporating to dryness in a vacuum; a dirty yellow product is thus obtained which dissolves in water with the characteristic red coloration of the pervanadates, and when treated with hydrochloric acid evolves oxygen and chlorine.

Strontium tetravanadate, $SrV_4O_{11} + 9H_2O$, which formed as a bye-product in the preparation of the pervanadate, crystallises in large, cherry-red crystals from the filtrate after precipitating the latter with alcohol.

Calcium vanadate, $Ca(VO_3)_2 + 3H_2O$, is obtained in bright yellow needles on adding calcium chloride to a solution of ammonium metavanadate and then precipitating with alcohol.

Manganese vanadate, $Mn(VO_3)_2$, is obtained in reddish-brown, six-sided plates by precipitating a solution of ammonium metavanadate with manganese sulphate and boiling the mixture until the amorphous precipitate becomes crystalline. E. C. R.

Antimonic Acids and Antimonates. By A. DELACROIX (*J. pharm.*, 1897, [vi], **6**, 337—341. Compare Frémy, *Ann. Chim. Phys.*, 1844, [iii], **12**, 499, and 1848, **22**, 404; Beilstein and von Bläse, Abstr., 1889, 1123).—Pyrantimonic acid is prepared as follows. Antimony pentachloride is added to 20—25 times its weight of cold water, the excess of chlorine being removed by drawing air through the liquid, and, after remaining for an hour or so, the precipitated hydroxide is transferred to a filter; it is extremely difficult to remove the last traces of hydrogen chloride. When left in contact with cold water, the hydroxide slowly dissolves, yielding a solution of pyrantimonic acid. At 15°, the solution contains 5·88 grams of Sb_2O_5 per litre; at 25°, 8·55 grams; at 60°, 21·30 grams. When treated with mineral acids, a precipitate is obtained, but organic acids have no action. The alkali hydroxides yield white precipitates soluble in water, but insoluble in an excess of alkali.

When titrated with alkali, using methyl-orange as indicator, neutralisation is reached when the ratio of alkali to Sb_2O_5 is 0·25 : 1. With phenolphthalein, the ratio is 0·5 : 1. The author has not been able to isolate the salt $K_2O,4Sb_2O_5$, but the salt $K_2O,2Sb_2O_5$ is readily obtained when the acid is treated with a slight excess of potassium hydroxide or acetate. A dilute solution of the acid, when treated with a slight excess of potassium hydroxide and then with much alcohol, yields crystals of the salt $KSbO_3$, which gives a characteristic precipitate with sodium salts; the sodium salt, $NaSbO_3$, is most readily obtained on adding sodium acetate to a solution of the pyro-acid.

The pyro-acid, when heated for some minutes at 100°, is transformed into the ortho-acid; the same transformation takes place slowly at the ordinary temperature, and the solutions thus obtained are feebly opalescent. The salt KSb_3O_8, the existence of which was indicated by using methyl-orange as indicator, could not be isolated, but the salt $2K_2O,3Sb_2O_5$ is easily prepared; it is less soluble than the normal pyrantimonate. J. J. S.

Basic Potassium Antimonates. By A. DELACROIX (*J. Pharm.*, 1897, [vi], **6**, 533—535. Compare preceding abstract).—The author concludes that Fremy's neutral potassium metantimonate does not exist.

A basic orthantimonate crystallising with $5H_2O$ was obtained by treating a 2 to 2·5 per cent. solution of Fremy's gum-like salt with several times its volume of alcohol. After heating at 100°, the crystals contain $3H_2O$.

The neutral orthantimonate, $2K_2O,3Sb_2O_5$, is obtained when a cold, freshly prepared solution of the so-called granular antimonate is treated with carbonic anhydride. The author thinks that the granular salt and the gum-like salt are both basic potassium orthantimonate.

J. J. S.

Melting Points of Silver and Gold. By DANIEL BERTHELOT (*Compt. rend.*, 1898, **126**, 473—476).—The melting points of silver and gold were determined by means of a thermoelectric couple of platinum and platinum-iridium. The values obtained for silver varied between 959·2° and 966·2° with a mean of 962°, whilst those for gold varied between 1062·1° and 1066·70, with a mean of 1064°. A summary of the results of previous observers is given, and it is noteworthy that, although the absolute values for silver and gold differ with different observers, the interval between the two melting points is in almost all cases about 100°. C. H. B.

Behaviour of Platinochlorides. By PAUL ROHLAND (*Zeit. anorg. Chem.*, 1898, **16**, 305—308. See also this vol., ii, 189).—The author discusses the conditions under which the platinochlorides of the alkalis and alkaline earth are dissociated into the alkali or alkaline earth haloid and platinum chloride; this dissociation appears to be chiefly determined by the temperature. Thus a solution of barium platinochloride deposits crystals of barium chloride at the ordinary temperature, but at temperatures above 80°, barium platinochloride is deposited. The bearing of conditions of the dissociation of platinochlorides on the estimation of potassium is also discussed. E. C. R.

Mineralogical Chemistry.

Kyanite, Zircon and Anorthite from North Carolina. By JULIUS H. PRATT (*Amer. J. Sci.*, 1898, [iv], 5, 126—128).—Kyanite occurs in decomposed mica-schist near North Toe river, Yancey Co., as large, transparent crystals of a rich grass-green colour; a few are deep blue in the centre with grass-green margins. Sp. gr. = 3·64. No traces of iron or chromium were found. A crystallographic description is given of this kyanite, and also of reddish-brown crystals of zircon from New Stirling, Iredell Co.

The anorthite of a troctolite at Buck Creek, Clay Co., is separated from the olivine by a zone of fibrous silicates, mainly enstatite. The anorthite is somewhat kaolinised, but in the interior is quite free from decomposition. Analysis by C. H. Baskerville of material having sp. gr. = 2·6995—2·7440 gave

SiO_2.	Al_2O_3.	FeO.	CaO.	MgO.	Na_2O.	K_2O.	Moisture.	Loss on ignition.	Total.
44·05	30·87	0·84	17·30	0·36	3·65	0·83	0·35	1·60	99·85

L. J. S.

Four New Australian Meteorites. By HENRY A. WARD (*Amer. J. Sci.*, 1898, [iv], 5, 135—140).—*Roebourne.*—This iron was found in 1894 at 200 miles S.E. of Roebourne in N.W. Australia; it measures 57 × 34 × 7 cm., and weighs 86·8 kilos. The Widmanstätten figures are quite regular, but are very dim on account of the great number of small flakes, probably of schreibersite. Troilite nodules are rare. Analysis by Mariner and Hoskins gave I.

Ballinoo.—This was found in 1893 on a tributary of the Murchison River, about 10 miles S. of Ballinoo, in Western Australia; it measures 34 × 27 × 11 cm., and weighs 42·9 kilos. It is an octahedral iron showing very minute Widmanstätten figures. Troilite, schreibersite, and perhaps graphite are present. Analysis II.

Mungindi.—Found in 1897 in Queensland, 3 miles north of Mungindi, P.O., in New South Wales; it measures 39 × 24½ × 17 cm., and weighs 28·1 kilos. A second mass weighs 51 lbs. It is an octahedral iron with well-marked Widmanstätten figures. Troilite and schreibersite are present. Analysis III.

	Fe.	Ni.	Co.	Cu.	Mn.	P.	S.	Si.	C.	Total.	Sp. gr.
I.	90·914	8·330	0·590	—	trace?	0·156	trace	0·010	trace	100·000	7·78
II	89·909	8·850	0·740	trace	—	0·501	trace	trace?	trace	100·000	7·8
III.	90·307	8·230	1·360	—	—	0·093	trace	trace?	0·010	100·000	7·4

Mooranoppin.—Found in or before 1893, near Mooranoppin, 160 miles E. of York in Western Australia. It is an octahedral iron, and the blades of kamacite are so broad that the Widmanstätten figures are not clear. Long fissures in the iron are filled with a black graphitic mineral, and nodules of the same are surrounded by troilite.

L. J. S.

Iron Meteorites as Nodular Structures in Stony Meteorites. By H. L. PRESTON (*Amer. J. Sci.*, 1898, [iv], **5**, 62—64).—It is argued that siderites were originally formed and encased in the stony matter of aerolites. It is also pointed out that siderites with a coarsely crystalline structure have rough pitted exteriors, whilst those which are finely crystalline have smooth exteriors. L. J. S.

Physiological Chemistry.

Influence of Bile and Bile Salts on Pancreatic Proteolysis. By RUSSELL H. CHITTENDEN and ALICE H. ALBRO (*Amer. J. Physiol.*, 1898, i, 307—335).—Pancreatic proteolysis, as it occurs in the normal intestine, takes place to a great extent in a neutral or alkaline liquid, and, under such conditions, the proportion of bile ordinarily present is not inimical to the process. If in artificial digestive mixtures of neutral, alkaline, or acid reaction the amount of bile, or bile salts, is increased beyond a certain small proportion, the process of pancreatic proteolysis is hindered. It is believed that the adjuvant power of bile spoken of by previous authors in connection with this process has been much exaggerated, and such small power as bile does possess in this direction is to be attributed to its reaction rather than to the presence of characteristic biliary constituents such as bile salts.

In connection with the reaction of bile, it is pointed out that, although bile is alkaline to litmus, it is acid to phenolphthalein, and that the reaction depends rather on the presence of phosphates than of sodium carbonate. W. D. H.

Power of Proteids in Conserving Emulsions. By B. MOORE and C. J. I. KRUMBHOLZ (*Proc. physiol. Soc.*, 1898, 54—56).—In conserving emulsions, albumose is practically inert, serum and egg-white nearly so, but acid and alkali albumin, especially the latter, are very effective. The formation of these albuminates during digestion must be of service in the digestion and absorption of fats. W. D. H.

Nutrition of the Infant. By AXEL JOHANNESSEN and EYVIN WANG (*Zeit. physiol. Chem.*, 1898, **24**, 482—510).—A large number of observations (weight, length, composition of the milk given, excretions, including sweat, heat development, &c.) relating to the growth of infants in different parts of the period of lactation.

The authors state they can draw no general conclusions, but present their facts in numerous lengthy tables. W. D. H.

Formation of Sugar from Fat in the Body. By J. WEISS (*Zeit. physiol. Chem.*, 1898, **24**, 542—544).—The following experiment is considered a proof that sugar can be formed from fat in the body.

The blood and liver of rabbits were divided into equal parts; to one half, an emulsion of olive oil, made with gum arabic, was added; to the other, gum arabic only. The mixtures were kept at 35–40° for 5 to 6 hours, the proteids coagulated by heat and acetic acid and filtered off, the sugar being estimated in the filtrate by Fehling's solution. If blood alone, without liver, was used, the two filtrates contained the same amount of sugar; if the liver was present, the half containing the oil yielded most sugar. The numbers given (sugar per cent.) are as follows.

	With oil.	Without oil.
1.	1·593	1·108
2.	2·542	2·046

With fatty acid, instead of oil, the difference is smaller.

	With fatty acid.	Without fatty acid.
1.	1·343	1·190
2.	2·404	2·100

W. D. H.

[NOTE BY ABSTRACTOR.—It seems doubtful whether the experiments described can be considered to prove the author's point.]

Physiology of the Suprarenal Capsule. By SWALE VINCENT (*Proc. physiol. Soc.*, 1898, 48–49, 57–58).—Removal of the suprarenal capsules of the eel, which, as in all teleosts, consist of what corresponds to cortex only of the mammalian gland, is not fatal.

Administration, by the mouth, of suprarenal capsules in large quantities to mammals (rabbits and dogs) produces no results. The active substance of the gland is not destroyed by gastric digestion *in vitro*, so apparently it is not absorbed when taken into the stomach.

W. D. H.

Iodised Fats in the Organism. By HUGO WINTERNITZ (*Zeit. physiol. Chem.*, 1898, **24**, 425–448).—The capacity of fats to unite with halogens has been long known, and von Hübl (Dingler's *Poly. J.*, **253**, 1884) gives the method for preparing the iodine additive compound. On administering such iodised fats to animals (dogs and birds, given both by the mouth and under the skin), toxic effects were looked for from the possible liberation of iodine; it appears that this is not the case, but that iodised fat is deposited in the organism, principally in the adipose tissue, but also in the fat of the bones, muscles, and liver, whilst traces pass into the milk. In artificial digestion experiments, the alkaline juices were found to liberate some iodine, whilst the gastric juice did not. The excretion of iodine in the urine continues for 10 days after the feeding is stopped.

The administration of potassium iodide does not lead to the formation of iodised fat in the body, except that traces were found in the mammary glands, bone, marrow (in hens), and in the hair.

W. D. H.

Behaviour of different Sugars after Subcutaneous Injection in Man. By FRITZ VOIT (*Chem. Centr.*, 1897, ii, 867–868; from *Deutsch. Arch. Klin. Med.*, **58**, 523–564. Compare Abstr., 1897, ii, 511).—Dextrose, levulose, and galactose are decomposed by the body cells, whereas sorbinose is recoverable in the urine. The pentoses (arabinose, xylose, and rhamnose) are only partially destroyed, and appear in great measure in the urine; the same occurs when they are given by the mouth. Cane-sugar and lactose appear almost quantitatively in the urine, and so contrast with maltose. In the case of trehalose, 15 to 17 per cent. of the amount injected was recovered in the urine; raffinose is also largely excreted in the same way. Glycogen is neither excreted as such nor as sugar; 34 per cent. of the achroodextrin prepared by diastase, 24 per cent. of that prepared by acid, 14 per cent. of erythrodextrin, and 28 per cent. of amylodextrin (excreted as achroo-dextrin) were recoverable in the urine. In these cases, no sugar was found in the urine. W. D. H.

Stercorin. By STANISLAS BONDZYŃSKI and V. HUMNICKI (*Zeit. physiol. Chem.*, 1898, **24**, 395—398).—Flint states (Abstr., 1897, ii, 575) that the substance koprosterol described by the authors is the same as that which he described under the name stercorin many years ago. This is disputed, and Marcet's *excretin* is regarded as nearer to koprosterol than stercorin, although Marcet did not recognise the possibility of its origin from cholesterol. W. D. H.

Intestinal Epithelium and Absorption. By E. WAYMOUTH REID (*Proc. physiol. Soc.*, 1898, 56—57).—The absorption of serum in loops of intestines in living dogs was investigated. Both water and solids are taken up by the intestinal wall when the hydrostatic pressure in the gut is well below that in the capillaries of the villi. The inorganic salts are absorbed rather more quickly than the water, the organic solids more slowly.

Removal of the epithelium by temporary ligature of the vessels, or by washing with distilled water, or poisoning of the epithelium by sodium fluoride, reduces or stops the absorption. W. D. H.

Excretion of Nitrogenous Substances in Diabetes Mellitus. By MARTIN JACOBY (*Chem. Centr.*, 1897, ii, 528; from *Zeit. klin. Med.*, **32**, 556—568).—In cases of diabetes mellitus, the ratio of total nitrogen to the nitrogen of alloxuric substances varies, with the severity of the case, from 24·9 to 38·7 : 1; the absolute value of the total alloxuric substances being between 0·29 and 1·03 grams. In a case of *diabetes insipidus*, the two numbers were respectively 18·6 : 1 and 0·57 grams. W. D. H.

Phloridzin-Diabetes in Dogs. By F. H. REILLY, F. W. NOLAN, and GRAHAM LUSK (*Amer. J. Physiol.*, 1898, i, 395—410).—Frequent subcutaneous injections of phloridzin in fasting dogs establish ultimately the ratio in the urine of dextrose : nitrogen = 3·75 : 1, which indicates a production of 60 grams of dextrose from 100 grams of proteid. Taking the fæcal nitrogen into account, the amount of dextrose obtainable from proteid may be more accurately estimated at 58·7 per cent.

The proteid metabolism may increase above that in simple fasting to an extent as high even as 560 per cent.

Dextrose given during phloridzin-diabetes is quantitatively eliminated; levulose and galactose are not eliminated as such, but only in so far as they are converted into dextrose. The administration of fat does not affect the ratio; the giving of meat also does not affect the ratio for the day, but the sugar from the proteid eaten may be eliminated before the nitrogen belonging to it, on account of an early preliminary cleavage of the molecule.

Gelatin yields the same amount of sugar as proteid, and spares much proteid from metabolism.

Intestinal putrefaction and fermentation can only have slightly affected the proteid or dextrose given in these experiments.

W. D. H.

A Case of Poisoning by Hydrogen Arsenide. By Wl. Gulewitsch (*Zeit. physiol. Chem.*, 1898, **24**, 511—512).—The urine in the case described was abundant, and contained hæmoglobin, albumin (1 per cent.), and urobilin. Bile acids and salts were absent. Traces of arsenic were found. W. D. H.

Physiological Action of Aldehyde, Salicylaldoxime, and Acetoxime. By Orazio Modica (*Chem. Centr.*, 1897, ii, 500; from *Ann. Chim. Farm.*, **26**, 289—301).—In dogs and frogs, salicylaldehyde produces chiefly paralysis, whilst its oxime stimulates, and only paralyses in large doses. In opposition to the observations of Curci, it is found that, after the administration of acetoxime, acetone is found in the urine, and the physiological action of acetoxime is probably due to the acetone liberated. W. D. H.

Physiological Action of Cotarnine. By Pio Marfori (*Chem. Centr.*, 1897, ii, 368, from *Ann. Chim. Farm.*, **25**, 241—251).—Cotarnine or stypticine differs from hydrastinine by containing the group OMe in place of a hydrogen atom. The present research is to ascertain whether its styptic properties are due, like those of hydrastinine, to its vaso-constrictive properties. This is not the case, nor does it act by hastening the coagulation of the blood. In the central nervous system, there is first stimulation and then paralysis.

W. D. H.

Chemistry of Vegetable Physiology and Agriculture.

Fermentation without Cells. By Eduard Buchner (*Ber.*, 1898, **31**, 568—574).—An account of a lecture delivered to the German Chemical Society. Fresh bottom-fermentation yeast from a Munich brewery, compressed under 50 atmos. pressure to remove water, is pounded in a porcelain mortar by mechanical power, after mixture with an equal weight of quartz sand and one-fifth of its weight of kieselguhr; by this treatment, 40 per cent. of the yeast cells are disintegrated. The mass, which has now become pasty, is subjected to a pressure of 500 atmos. in a hydraulic press, the expressed juice being allowed to fall on to a fluted paper filter, and collected in a vessel kept cool with ice; after 2 hours, the cake is broken up, moistened with water, and again pressed. From 1 kilo. of yeast, 500 c.c. of extract is obtained, although only 140 c.c. water has been added. The residual cake has now but little power of inducing fermentation; in it only 4 per cent of the yeast cells are intact, and of about 60 per cent. nothing but empty cell-walls remain.

This extract contains *invertin*, a *maltase*, and a *ferment* capable of hydrolysing glycogen. Further, it appears to contain an *oxydase*, for it turns brown after long exposure to the air; it also contains a *proteolytic enzyme*, for, although the fresh extract coagulates when heated to 50°, it no longer does this after it has been allowed to remain for a week at the ordinary temperature. Most important of all, it ferments sugar to alcohol and carbonic anhydride, and this no less rapidly than fresh yeast does; the agent of the change may be named *zymase*. 200 c.c. of the extract, freed from dissolved carbonic anhydride by exposure under diminished pressure, is mixed with sugar to a concentration of 16 per cent., and 2 per cent. of potassium metarsenite added. This mixture gave 15 grams of carbonic anhydride by the time it had stood 40 hours at 15°; all the sugar (33·4 grams) had disappeared, and 15 grams of alcohol were obtained. The fermentation cannot be induced by the few micro-organisms present; it is too rapid for that, and, moreover, the extract induces fermentation even after it has been freed completely from organisms by filtration. Further, it cannot be due to the action of living protoplasm present in the extract, for it is not hindered by the presence of arsenious acid, chloroform, benzene, or large quantities of glycerol or sugar. The fermentation has exactly the character of the ordinary fermentation with yeast, alcohol and carbonic anhydride being formed in about equal amounts; cane-sugar, maltose, grape-sugar, and levulose are fermented, lactose and mannitol are not.

There is never absolute certainty that zymase will be present in the extract from a given sample of yeast; occasionally it is absent without apparent reason. C. F. B.

Oxydase of Grapes; its Utility in Wine-making. By A. Bouffard and L. Semichon (*Compt. rend.*, 1898, **126**, 423—426).—The preparation of white wines from purple grapes is readily effected by taking advantage of the presence of an oxydase in the grape juice. A current of air, as finely divided as possible, is passed into the must, and through the medium of the ferment the colouring matter is thereby oxidised and consequently precipitated. The point at which complete precipitation of the colouring matter has been effected is readily ascertained by filtering some of the must, which should, of course, be colourless. Prolonged passage of the current of air is to be avoided, since it tends to make the wine yellow and then brown.

The oxydase is present chiefly in the vascular tissue of the grapes, and they should be subjected to moderately heavy crushing, in order that the proportion of the oxydase in the must may be sufficient, but not much more than sufficient, to promote fairly rapid precipitation of the colouring matter. If any oxydase is left in the wine after fermentation, it tends to produce an injurious yellow colour, and consequently it is advisable to destroy the oxydase by adding a small quantity of sulphurous acid in the form of potassium hydrogen sulphite, 2 to 5 grams per hectolitre being sufficient. A similar addition is advisable in the case of white wines prepared from white grapes, and also in the case of pale wines. In the manufacture of red wines, it is important that the grapes should be crushed carefully, so that the proportion of oxydase in the must may be as low as possible, otherwise too much of the colouring matter may be precipitated.

When all the colouring matter has been precipitated with a view to the preparation of white wine, it is not necessary to remove the precipitate before fermenting the must in the usual way. C. H. B.

Oxidation of Compound Ammonias by Ferments in Soils. By E. Demoussy (*Compt. rend.*, 1898, **126**, 253—256).—Experiments were undertaken with a view to throw light on the changes experienced in soils by organic matter of the nature of amines. The compounds investigated were placed in flasks containing water, calcium carbonate, and potassium phosphate, sterilised, mixed with some garden soil, and kept at 30°. Methylamine, in the form of sulphate, is completely converted into ammonia after some days, and subsequently, but not before, nitrites and nitrates are formed. The change does not take place in the absence of soil, nor in the absence of calcium carbonate. No change takes place in a vacuum, and the presence of oxygen is essential, which indicates that the alkyl radicle is oxidised. Trimethylamine is oxidised much more slowly, but the change is direct, and the three methyl groups are attacked simultaneously, no methylamine being formed as an intermediate product. Aniline is oxidised very slowly, and pyridine still more slowly, whilst quinoline yields traces of ammonia only after several months, oxidation being more difficult the more complex the molecule. C. H. B.

Nitrification Bacteria. By Albert Stutzer and R. Hartleb (*Chem. Centr.*, 1897, ii, 502; from *Centr.-Bl. f. Bakt. u. Parasitenk.*, 3, ii, 311—321. Compare this vol., ii, 301 and 302).—The organisms which bring about nitrification are able to obtain carbon from the carbonic anhydride of the atmosphere or from soluble carbonates. They are unable, however, to assimilate the carbonic anhydride of calcium carbonate, just as Godlewski showed was the case with magnesium carbonate, provided the culture liquids contain no carbonic anhydride, and the culture is kept in an atmosphere free from this gas. It does not follow, however, that the natural carbonates, which are insoluble in water, are not of use to the organism, for carbonic anhydride is always being liberated by the action of the acids formed by the oxidation of nitrogenous compounds in the process of nitrification.

The presence of even small quantities of glycerol enables the organism to obtain carbon, and to form nitrate from nitrite, and when larger quantities are present the organism becomes more highly developed, forming thread-like bacteria with mycelium filaments. When a culture well supplied with carbon in the form of glycerol or similar substance, and of nitrogen in the form of nitrite, is kept deprived of atmospheric oxygen, the organism obtains its oxygen from the nitrite, and nitrogen is liberated. Bicarbonates are good nutritive materials, and enable the organism to oxidise nitrites, although only when supplied with oxygen; the organism may, however, live for a long time when deprived of free oxygen, but is then quite inactive. Ammonium carbonate is an unsuitable source of carbon. As the culture, which consists of a solution of gelatin in potable water containing potassium phosphate, becomes exhausted, the mycelium threads, the micrococci and the spore-tubes become smaller, and nitrates are only formed when the culture begins to be poor in assimilable carbon, and the whole of the soluble organic nitrogen compounds are oxidised to nitrite. At this stage, nitrification is effected by the micrococci and bacilli. The production of nitrite is not associated with organisms of any particular shape, for this depends on the material in which they are cultivated.

The nitrifying organisms found in the soil of the Cameroons are physiologically and morphologically identical with those of German soil. E. W. W.

New Method of Disinfection. By REINHOLD WALTHER and ARTHUR SCHLOSSMAN (*J. pr. Chem.*, 1898, **57**, 173—197).—After a lengthy review of all the known methods of disinfection, the authors state that by far the best results are obtained by using a solution of formaldehyde in glycerol, which they call "glycoformal." This is dispersed through the room to be disinfected in the form of a very fine mist, half an hour sufficing to absolutely destroy all germs. Details of the method will be published on another occasion. A. W. C.

Analytical Chemistry.

Methods of Gas Analysis. By JOHN S. HALDANE (*J. Physiol.*, 1898, **22**, 465—480).—Some forms of gas-burettes and other details in the methods used by the author in his work on the gases of the air and blood, are described and figured. W. D. H.

Separation and Estimation of Bromine, Chlorine, and Iodine. By ADOLPHE CARNOT (*Compt. rend.*, 1898, **126**, 187—191).—Iodine is liberated by adding a solution of nitrogen oxides in sulphuric acid, separated by means of carbon bisulphide, and estimated by titration with sodium thiosulphate, after washing the bisulphide solution with water. In the same liquid, the bromine, liberated by adding sulphuric and chromic acids and heating at 100°, is separated by means of carbon bisulphide, and estimated by adding excess of potassium iodide to the bisulphide solution (after washing), and then titrating with thiosulphate. After removal of the iodine and bromine, chlorine is estimated either by precipitation or volumetrically. The total halogens may also be determined gravimetrically or volumetrically in a separate portion of the liquid, the chlorine being afterwards estimated by difference.

The separation of the iodine and bromine is best conducted in a separating funnel with a well-fitting stopcock, closed at the top with a glass stopper. The glass should be thin, so that the funnel may be floated in water at 100° to ensure complete liberation of the bromine. C. H. B.

Estimation of Sulphur in Iron. By LOUIS CAMPREDON (*Chem. Centr.*, 1897, ii, 383; from *Stahl und Eisen*, **17**, 486—489).—The author thinks that Schulte (this vol., ii, 45) is wrong in supposing that iron, when treated with hydrochloric acid, yields all its sulphur as hydrogen sulphide. Sometimes only one-half of the sulphur is obtained in that form, the remainder being evolved in other gaseous forms, which, however, are converted into hydrogen sulphide when passed through a red-hot glass tube.

The best solvent for iron is a mixture of 2 parts of dilute hydrochloric acid (1 : 2) and one part of dilute sulphuric acid (1 : 4). L. DE K.

Estimation of Sulphur in Iron. By WILHELM SCHULTE (*Chem. Centr.*, 1897, ii, 383; from *Stahl und Eisen*, **17**, 489—493).—The author, in reply to Campredon (see preceding abstract), states that he is well aware of the fact that a considerable part of the sulphur is not evolved as hydrogen sulphide. The apparatus should be previously filled with carbonic anhydride and the gases passed through a combustion tube 15—20 cm. long heated to dull redness. L. DE K.

Estimation of Carbon, Nitrogen, and Halogens by means of Alkali Persulphates. By HEINRICH BRUNNER (*Chem. Centr.*, 1897, ii, 389; from *Schweitz. Wochschr. Pharm.*, **35**, 280—281).—The author has previously shown that organic carbon is completely oxidised by means of potassium persulphate mixed with potassium permanganate. The nitrogen is liberated as such, but in the presence of a sufficient amount of alkali, it is completely converted into ammonia. The process is also applicable to the estimation of the halogens; chloral, for example, when heated with potassium persulphate, yields free chlorine which may be collected in an absorption apparatus containing potassium iodide solution. L. DE K.

Estimation of Nitrogen in Manures. By ARTHUR DEVARDA (*Chem. Centr.*, 1897, ii, 64—65; from *Österr.-ungar. Zeit. Zucker-Ind.*, 1897).—A quantity of the sample which should contain not more than 0·4 gram of saltpetre is dissolved in 150 c.c. of water and 8 c.c. of aqueous potash of sp. gr. = 1·3, and 1·5 grams of an aluminium alloy containing 59 per cent. Al, 39 of copper and 2 of zinc is added. The flask is at once connected with a suitable distillation apparatus, and after half an hour the ammonia is distilled off and titrated. To obtain the remainder of the nitrogen, 25 c.c. of strong sulphuric acid and half a gram of mercury are added and the process continued as in Kjeldahl's method. L. DE K.

Estimation of Phosphorus in Phosphides. By LÉON FRANCK (*Zeit. anal. Chem.*, 1898, **37**, 173—176).—The following method was devised for the estimation of the phosphorus in aluminium phosphide, a substance which is decomposed by water, acids, and alkalis, with evolution of hydrogen phosphide. A flask is fitted with a separating bulb, through which carbonic anhydride from a Kipp's apparatus can be introduced. An evolution tube (carrying a Bunsen's valve to prevent regurgitation) connects the flask with a series of three absorption vessels (Blum's) containing respectively 20, 20, and 15 c.c. of hydrochloric acid saturated with bromine. Having filled the whole apparatus with carbonic anhydride, the substance (0·3—0·4 gram), weighed in a stoppered tube, is introduced into the dry flask, and carbonic anhydride again passed through; 50 c.c. of water, followed by 50 c.c. of dilute sulphuric acid (1 : 2), is then slowly dropped in. After half an hour's repose, the contents of the flask are boiled for half an hour, and the last traces of gas are swept out by carbonic anhydride. The hydrogen phosphide is completely absorbed by the bromine, and oxidised to phosphoric acid, which, after evaporating the contents of the absorption vessels to dryness on the water bath, is estimated by the usual processes. A blank experiment is advisable for ascertaining the purity of the reagents. An attempt to substitute dilute nitric acid for the sulphuric acid resulted in a violent explosion.

M. J. S.

Estimation of Phosphorus in Steel and Iron. By LEOPOLD SCHNEIDER (*Chem. Centr.*, 1897, ii, 385; from *Österr. Zeit. Berg-Hütt.*, **45**, 326—328).—This paper deals with the various modifications of the molybdate method. As the phosphorus is not completely oxidised by nitric acid alone, the oxidation must be completed with potassium permanganate, the excess of the latter being removed by oxalic or tartaric acid, or ferrous sulphate. The precipitation is best effected by means of a strongly acid solution, containing much ammonium nitrate; and if time is no object, the operation is best carried out in the cold, so as to avoid precipitation of molybdic acid. The yellow precipitate may be very conveniently treated, according to Pinkener's directions, namely, by gently igniting it, when it will contain 1·65 per cent. of phosphorus. The volumetric estimations based on the reduction of the molybdic acid are not recommended. Silicon does not interfere, but arsenic and tungstic acids should be first removed.

L. DE K.

Estimation of Small Amounts of Phosphoric Acid. By ADOLF JOLLES and FRIEDRICH NEURATH (*Monatsh.*, 1898, **19**, 5—15).—When the yellow precipitate obtained by the action of ammonium molybdate on a phosphate is dissolved in ammonia, and the solution evaporated, a white *salt* of the composition $(NH_4)_3PO_4,5(NH_4)_2Mo_2O_7$, is obtained, which is characterised by giving delicate colour reactions with salts of the heavy metals, and a yellow colour with many organic acids, although not with hydroxy-acids. The authors propose the following method for the estimation of small amounts of phosphoric acid. The solution to be tested is first precipitated with ammonium molybdate, and the precipitate dissolved in ammonia, and evaporated; the phosphoric acid is then determined by comparing the intensity of the bluish-green colour produced by ferrous sulphate, with that produced in a solution of phosphomolybdate containing a known amount of phosphoric acid. By this reaction, as little as 0·00004 gram P_2O_5 can be detected in 20 c.c. of water.

A second method is based on the fact that phosphoric acid gives only a yellow coloration with sodium or potassium molybdate, the intensity of which increases with the temperature. The following is the procedure :—20 c.c. of the solution to be tested is placed in a test-tube, and, in a second tube, 20 c.c. of a solution in which the amount of phosphoric acid is known. A similar quantity of sodium molybdate is then added to each, and the colours compared. The reaction, which detects as little as 0·000025 gram P_2O_5 in 20 c.c. of water in the cold, and 0·0000025 gram on warming, is not hindered by the presence of other inorganic salts. A. W. C.

Estimation of Boric Acid in Meat. By C. FRESENIUS and GEORG POPP (*Chem. Centr.*, 1897, ii, 69 ; from *Zeit. öffentl. Chem.*, **3**, 188—190).—Ten grams of the chopped meat is triturated in a mortar with 40 to 80 grams of anhydrous sodium sulphate, and dried in the water oven ; the mass is then finely powdered, if necessary, with the addition of more sodium sulphate, introduced into a 300 c.c. Erlenmeyer flask, and 100 c.c. of methylic alcohol added. After standing for 12 hours, the alcohol is distilled off ; 50 c.c. more methylic alcohol is poured on to the residue, and this is again distilled off. The distillate is finally made up with methylic alcohol to 150 c.c., and 50 c.c. of this is mixed with 50 c.c. of water and 50 c.c. of 50 per cent. glycerol solution containing phenolphthalein, and carefully neutralised with soda ; after thoroughly mixing the liquid, it is carefully titrated with N/20 soda solution, 1 c.c. of soda = 0·0031 gram of crystallised boric acid. Another portion of the alcoholic distillate may be ignited, when, if boric acid be present, the characteristic green flame will be noticed.

The exhausted meat may be incinerated, and the ash tested for borates. L. DE K.

Gas-Volumetric Estimation of Carbon in Iron and Steel. By EDUARD DONATH and W. EHRENHOFER (*Chem. Centr.*, 1897, ii, 61—62 ; from *Österr. Zeit. Berg.-Hütt*, **45**, 284—286).—The apparatus is a modification of the one recommended by Wiborgh. According to the supposed richness in carbon, 0·2 to 4 grams of the sample is treated with 10 times its weight of a saturated solution of copper sulphate, and the spongy mass is then oxidised by heating with sulphuric acid previously diluted with one-fifth of its bulk of water and a sufficiency of chromic acid. The volume of the gases given off is measured, and the carbonic anhydride found by absorption.

L. DE K.

Estimation of Carbonic Anhydride in the Air. By W. LEWASCHEW (*Chem. Centr.*, 1897, ii, 67—68 ; from *Hyg. Rundsch.*, **7**, 433—437).—The process is based on the same principle as the well-known Pettenkofer's method, in so far as baryta-water is titrated with oxalic acid, before and after exposure to the sample of air.

The baryta-water is contained in a 100 c.c. flask, fitted with a perforated indiarubber cork closed by a glass rod. After removing the rod, the flask is inverted and its neck pushed into the perforated indiarubber cork fitted to a 6 litre flask, which has been previously filled with the suspected air by means of a pair of bellows. By reversing the flask, the baryta-water runs back into the small flask, and can be titrated.

L. DE K.

Colorimetric Estimation of the Denseness of Smoke. By P. FRITZSCHE (*Zeit. anal. Chem.*, 1898, 37, 92—94).—A known volume of the flue gases (10—20 litres) is aspirated through a cotton wool filter. The latter, after using its cleaner portion for wiping out the tubes, is shaken vigorously with 200 c.c. of water in a stoppered bottle, and the greyish liquid is poured into a test tube 40—50 mm. in diameter. The depth of colour is then compared with a scale of paper discs tinted with Indian ink, which have been standardised once for all, by comparison with known weights of soot shaken up with water and cotton wool exactly as above.

M. J. S.

Detection of Traces of [Normal] Alkali Carbonates in the Presence of an Excess of Acid Carbonate or of Borax. By ALEX. LEYS (*J. pharm.*, 1897, [vi], 6, 440—442).—Large quantities of acid carbonates or of borax prevent the formation of a precipitate when an alkali carbonate is mixed with magnesium sulphate. A delicate test for small quantities of normal alkali carbonates in the presence of bicarbonates or borax is a saturated solution of calcium sulphate. Even traces of a normal carbonate give an immediate precipitate, whereas a pure bicarbonate gives a crystalline precipitate only after some time, and borax gives no precipitate.

J. J. S.

Analysis of Bar Copper. By WILHELM HAMPE (*Chem. Centr.*, 1997, ii, 222—223, 391, 811—812; from *Berg.-Hüttenm. Zeit.*, 56, 145—147, 201—203, 297—299).—A reply to Murmann (Abstr., 1897, ii, 346), who objects to the author's process for estimating oxygen in bar copper.

Copper filings should be used, and these should be boiled for a few seconds in weak aqueous potash to dissolve any greasy matter present. The metal is then washed, first with water and subsequently with absolute alcohol.

The author does not agree with Murmann, who has stated that foreign oxides are not so readily reduced by hydrogen as cuprous oxide. To estimate the latter, the metal foil is treated with excess of a 6 per cent. solution of silver nitrate, which dissolves the metallic copper completely, but only one-third of the cuprous oxide. The precipitate, consisting of metallic silver and basic copper nitrate, is then dissolved in dilute nitric acid, and the solution freed from silver by cautiously adding hydrochloric acid; any copper is estimated in the filtrate.

If it is desired to estimate the metallic copper directly, a large quantity, say 50 grams, of the sample may be taken, and the copper precipitated by electrolysis. It is, however, advisable to stop the current before the metal has been completely deposited; the last portions of copper are then precipitated from the solution and weighed as sulphide.

L. DE K.

[Volumetric Estimation of Cerium.] By ERNST HINTZ (*Zeit. anal. Chem.*, 1898, 37, 94—111).—See this vol., ii, 339.

Assay of Nickel-Copper Alloys. By Alfred Riche (*Journ. Pharm.* 1897, [vi], 6, 300—303).—The nitric acid solution of the alloy is twice evaporated to dryness with a few drops of sulphuric acid, and the copper estimated by the usual electrolytic method. The solution from which the copper has been deposited is then treated with an excess of ammonia and the nickel deposited electrolytically by the aid of three Daniell's cells. J. J. S.

Electrolytic Estimation of Manganese and the Separation of Iron from Manganese. By Friedrich Kaeppel (*Zeit. anorg. Chem.*, 1898, 16, 268—283).—A dense deposit of manganese peroxide which is not easily separated from the electrode, is obtained by adding acetone to the electrolyte. The manganese sulphate solution, contained in a platinum dish, is maintained at 50—55°, great care being taken that the dish is evenly heated and that the temperature remains constant: with a current of 0·7 to 1·2 ampères and a potential difference of 4—4·25 volts, from 0·15 to 1·6 grams of manganese peroxide is deposited in 2 to 5½ hours. To obtain a good deposit requires the addition of 1·5 to 10 grams of acetone, according to the amount of manganese present. About 150 c.c. of manganese solution is employed, and during the electrolysis the volume must be kept constant by allowing water to drop into the platinum dish from a dropping funnel. The deposit of manganese peroxide is washed without breaking the current, dried at 150 to 180°, and weighed as anhydrous peroxide. The results which the author obtained are accurate.

The estimation of iron in the presence of manganese is most advantageously carried out as follows. The solution of iron and manganese sulphates is poured into a boiling solution of sodium pyrophosphate, employing about 12 grams of the pyrophosphate for about 0·15 gram of iron; after a clear solution is obtained, 3 to 4 drops of phosphoric acid are added, and if this causes a turbidity, sodium pyrophosphate is added until the solution becomes clear. During the electrolysis, the solution is kept at 30—40°, and, with a current of 1·8 to 2·5 ampères, the electrolysis is complete in 8—9 hours. The deposit of metallic iron, which adheres well to the platinum dish, is washed without breaking the current, and afterwards washed with absolute alcohol and dried at a low temperature. The results are fairly accurate, being about 0·15 per cent. too low. E. C. R.

Estimation of Hydrogen Cyanide in Ethereal Oil of Bitter Almonds. By F. Dietze and by Anton (*Zeit. anal. Chem.*, 1898, 37, 204; from *Zeit. Allegem. österr Apoth.-Vereins*, 50, 942)—According to Dietze, *Oleum amygdalarum aethereum* should contain between 1·5 and 2 per cent of hydrocyanic acid. Anton gives the following modification of Vielhaber's method:—2 grams of the substance is mixed with 10 grams of magnesium hydroxide, 10 c.c. of water, and a few drops of potassium chromate solution, and is titrated with N/10 silver nitrate, exactly like a chloride. 1 c.c. = 0·0027 gram of HCN.

M. J. S.

Volumetric Estimation of Zinc and Manganese. By George C. Stone and D. A. van Ingen, and by Edmund H. Miller and John A. Mathews (*J. Amer. Chem. Soc.*, 1897, 19, 542—547 and 547—558). See this vol., i. 347, 348.

Estimation of Phenols in Ethereal Oils. By EDWARD KREMERS and OSWALD SCHREINER (*Chem. Centr.*, 1897, ii, 147—148; from *Pharm. Rev.*)—To estimate thymol, the following process is recommended. A known weight of the sample is mixed in a glass-stoppered burette with an equal volume of light petroleum, and after carefully noting the volume, it is agitated with 5 per cent. aqueous potash and the alkaline layer is drawn off into a graduated 10 c.c. measure, the operation being repeated several times until no further diminution of the oily layer takes place. To make sure that all the thymol has been removed, a drop of the oil is dissolved in 20 drops of chloroform and gently warmed with a small piece of sodium hydroxide. If thymol is present, the liquid turns red.

The alkaline liquid is then made up to a definite bulk, and the thymol titrated in an aliquot part with N/10 iodine solution in the usual manner; it appears that the results obtained by titration are about 3 per cent. lower than the decrease in volume. Other phenolic compounds are similarly estimated. L. DE K.

Discrimination of Guaiacol and Creosote. By S. VREVEN (*Zeit. anal. Chem.*, 1898, **37**, 132; from *Mon. Pharm.*, 1896, 549).—To a drop of the liquid in a test-tube 2—3 drops of ether and one or two drops of concentrated nitric and hydrochloric acids are added, and the mixture is shaken, when it acquires a brownish-red colour.

On spontaneous evaporation of the ether, guaiacol yields needle-shaped crystals, whilst creosote produces only oily drops. Phenol gives a similar reaction, but the crystals are easily distinguished from those of guaiacol. M. J. S.

New Method of Estimating Sugar. By KARL B. LEHMANN (*Chem. Centr.*, 1897, ii, 233; from *Pharm. Post.*, **30**, 331).—A measured quantity of Fehling's solution containing a known weight of copper is mixed with a known volume of sugar solution and boiled until the reduction is complete. The liquid is then made up to a definite bulk, and when the cuprous oxide has subsided, an aliquot part of the liquid is pipetted off.

After adding a slight excess of sulphuric acid, the excess of copper is titrated in the well-known way with potassium iodide and sodium thiosulphate, using starch as indicator. L. DE K.

Technical Estimation of Invert-Sugar by Peška's Method. By K. ANDRLIK (*Chem. Centr.*, 1897, ii, 393—394; from *Zeit. Zuck. Ind. Böhm.*, 21, 569—583).—The solution is clarified with basic lead acetate, the excess of lead removed with sodium sulphate or phosphate, the filtrate examined polarimetrically, and then diluted to such an extent that 100 c.c. contain 2·5 grams of sucrose. The liquid is then treated for invert-sugar by means of Peška's ammoniacal copper solution. Tables and curves are given in the original paper.

L. DE K.

Estimation of Sugar and the Polarimetric Examination of Sweet Wines. By ARTHUR BORNTRÄGER (*Zeit. anal. Chem.*, 1898, 37, 145—172).—The wine is accurately neutralised with an alkali hydroxide, at first in the cold, but heating as the end is approached, then evaporated on the water bath to about half its volume (but not to a syrup); decolorised, after cooling, with a "moderate" amount of basic lead acetate (the meaning of which seems to be that the excess should be as small as possible), made up to its original volume, and filtered through dry paper. After not less than 12 hours, the liquid, which must be neutral or feebly acid, is fit for both optical examination and titration by the Fehling-Soxhlet method. To detect and estimate saccharose, the wine, mixed with one-tenth of its volume of hydrochloric acid of sp. gr. = 1·1, is heated for 15 minutes at 65—70°, then neutralised and treated as before, the presence of saccharose being indicated by an increase of lævorotation, and its amount calculated from the increase in the reducing power. In justification of the above mode of procedure, the author has investigated the influence of the several operations and conditions (compare this vol., ii, 264), and shows, both from his own experiments and those of others, (1) that both dextrose and levulose undergo a transient diminution of rotatory power when their solutions are evaporated or even heated; (2) that whilst the presence of basic lead acetate diverts the optical rotation of invert-sugar towards the right, neutral or acid lead solutions are absolutely without influence; (3) that the volume of the lead precipitate may be neglected without sensible error, or, at most, only compensates for the precipitation of a trace of invert-sugar by the basic lead acetate; (4) that the optical and chemical properties of invert-sugar are not affected by prolonged contact with normal lead acetate; (5) that no error results from the limited evaporation of the neutralised wine; (6) that the presence of much lævorotatory sugar does not prevent the detection of small quantities of saccharose; (7) that the removal of the alcohol by evaporation is essential; (8) that precipitation of the excess of lead by sodium carbonate, as prescribed in the official German and Italian methods, is a source of error, since the rotation of an invert-sugar solution is increased by the presence of soda; sodium sulphate and phosphate seem free from this objection.

M. J. S.

Detection of Carbohydrates. By B. SJOLLEMA (*Chem. Zeit.*, 1897, 21, 739).—The reagents consist of a 10 per cent. solution of cupric sulphate to which an excess of ammonia has been added just sufficient to redissolve the precipitate, and a 5 per cent. solution of cupric acetate containing a little free acetic acid which has been treated with ammonia in the same way as the sulphate. Two c.c. of the sugar solution is mixed with 0·5 c.c. of the reagent. The sulphate solution is a delicate test for glucose, yielding a voluminous precipitate with a solution containing 0·5 per cent. or even less of this sugar; for the detection of levulose, the acetate should be employed. The presence of saccharose does not interfere. Lactose and galactose also give insoluble copper compounds; to detect galactose, the acetate solution should be used, as the sulphate is not very suitable for either lactose or galactose. Excess of ammonia interferes with the lactose reaction more than it does with the hexoses. The author has not yet tried the behaviour of mannose and maltose towards ammoniacal copper solutions.

L. DE K.

Methods of Estimating the Quality of Flour. By VICTOR VEDRÖDI (*Zeit. anal. Chem.*, 1898, **37**, 87—92).—In 1893 (*Zeit. angw. Chem.*, 691) the author proposed to distinguish the different grades of flour by the estimation of the ash, on the ground that the larger the amount of bran in the flour the higher will be the percentage of ash; and the following limits were laid down.

No.	0	1	2	3	4	5	6	7	8
Limits of percentage of ash.	0·24	0·35	0·40	0·44	0·53	0·61	0·71	1·17	1·81
	0·34	0·39	0·43	0·52	0·60	0·70	1·16	1·80	3·15

To this it was objected by Cerkez (*ibid.*, 1895, 663) that the method would operate prejudicially against mills employing mill-stones, since the introduction of a few hundredths per cent. of mineral matter abraded from the stones would suffice to lower the apparent quality of the flour by several grades, and it was proposed to adopt the percentage of oil as the criterion of quality, the limits laid down being as follows.

No.	0	1	2	3	4	5	6	7	8
Limits of percentage of oil.	0·60	0·96	1·06	1·16	1·26	1·46	1·63	1·85	2·51
	0·95	1·05	1·15	1·25	1·45	1·62	1·84	2·50	3·45

The author has now estimated both the oil and ash in 56 samples of flour from mills employing both steel rollers and mill-stones, and has compared the grades indicated by the determinations, with those assigned by the millers on the basis of eye estimations. The latter agree with Cerkez's numbers in only 19 cases, whilst in 40 cases they agree with the numbers deduced from the ash determinations. Where differences exist, they are of greater magnitude with the former method than with the latter, and the fact that the ash method, when it differs from the eye estimation, usually assigns the higher value to the flour is a proof that the objection advanced by Cerkez is groundless. The ash estimations were all made by incinerating 5 grams of flour in porcelain crucibles in a muffle heated by gas.

M. J. S.

Detection of Chloral Hydrate in Urine. By VICTOR KULISCH (*Chem. Centr.*, 1897, ii, 391—392; from *Pharm. Post*, **30**, 303.)—The urine passed in 24 hours is evaporated to a small bulk, acidified with dilute sulphuric acid, and agitated three times in succession with 100 c.c. of a mixture composed of 2 parts of ether and 1 part of alcohol; the ether is then evaporated and the residue distilled with 100 c.c. of hydrochloric acid, sp. gr. = 1·06, or of sulphuric acid, sp. gr. = 1·1. The products of decomposition of any chloral administered and passed into the urine then yield furfuraldehyde, which is readily detected by a test paper impregnated with a solution of xylidine, or aniline, in (50 per cent.) acetic acid. An estimation may be attempted by converting it into furfuramide.

L. DE K.

Detection of Acetone in Urine. By A. MALLAT (*J. Pharm.*, 1897, [vi], **6**, 296—298).—The author finds that urines which do not give the iodoform test for acetone previously described (*Ann. Méd.*

Thermale, 1886), give the reaction when they have been distilled. It is therefore recommended to always distil over one-fourth of the sample of urine and to test the distillate, after the removal of alcohol, if this is present, by the iodoform test. J. J. S.

Volumetric Estimation of Acetone in Urine. By M. Martz (*Chem. Centr.*, 1897, ii, 232—233; from *Rép de Pharm.*, 1897, 197).—Fifty c.c. of the urine is mixed with 1 c.c. of phosphoric acid and distilled until 20 c.c. has passed over; 5 c.c. of the distillate is then mixed in a 250 c.c. flask with 30 c.c. of soda solution and 25 c.c. of iodine solution, and allowed to remain for 25 minutes; a blank experiment is started at the same time, using water instead of urine. Both the liquids are now acidified with 30 c.c. of dilute sulphuric acid (1 : 10), and titrated with N/10 solution of sodium thiosulphate, using 5 c.c. of a 2 per cent. starch solution as indicator. The difference between the two titrations multiplied by 0·001214 represents the amount of acetone.

The iodine solution is prepared by dissolving 25 grams of iodine and 50 grams of potassium iodide and making up to 1 litre; the soda contains 80 grams of sodium hydroxide per litre. L. de K.

Application of the Carvoxime Method for Estimating Carvone in Adulterated Oil of Spearmint. By Edward Kremers and Oswald Schreiner (*Chem. Centr.*, 1897, ii, 146; from *Pharm. Rev.*, 1896).—A sample of oil of spearmint adulterated with 33·33 per cent. of cedar-wood oil and 16·66 per cent. of gurjun balsam would still fulfil the requirements of the American pharmacopœia as regards density and polarisation. The percentage of carvone, which in pure oil of spearmint should amount to 56·4 per cent., is, however, reduced to 28·2 per cent. To estimate this carvone, 10 grams of the sample is treated with hydroxylamine, the volatile compounds are driven off in a current of steam, and the residual carvoxime is collected, dried, and weighed. L. de K.

[Hopkins' Method of Estimating Uric Acid.] By Gottfried von Ritter (*Zeit. physiol. Chem.*, 1898, **24**, 410—411).—A reply to some strictures passed on the author's work by Folin (this vol., ii, 196). W. D. H.

Estimation of Fat in Milk and Milk Products. By Arthur Devarda (*Chem. Centr.*, 1897, ii, 151; from *Österr ung. Zeit. Zucker-Ind. ü. Land*, 1897).—The author recommends the processes devised by Soxhlet and Gerber; the refractometric process of Wollny has not yet been sufficiently tried. To preserve milk for analytical purposes the addition of potassium dichromate or formaldehyde is recommended. L. de K.

Characteristic Reaction of Cotton-Seed Oil. By Georges Halphen (*J. Pharm.*, 1897, [vi], **6**, 390—392).—Equal volumes (about 1—3 c.c. of each) of the oil under examination, of amylic alcohol, and of carbon bisulphide containing 1 per cent. of free sulphur, are placed in a tube, and the whole then heated in a boiling solution of sodium chloride for 10—15 minutes. If cotton-seed oil is present, a red or orange coloration is developed; if no coloration is formed, another c.c. of the carbon bisulphide solution is added, and the mixture again warmed. J. J. S.

Detection of Tallow in Lard. By MATHIAS BALLÓ (*Chem. Centr.*, 1897, ii, 392; from *Zeit. Nahr. Hyg.*, &c., 11, 193—197).—About 60 grams of the melted fat is introduced into the 150 c.c. pear-shaped bulb of a specially-constructed apparatus, and after being allowed to cool for an hour and a half, is placed in ice for another hour. Pure lard absorbs no air, but when even small quantities of tallow are present, a considerable amount of air is absorbed, pure tallow taking up as much as 6·5—8·8 c.c. of air per 100 grams. On dissolving the fat in 100 c.c. of chloroform, the air is liberated, and may be collected in the special burette. It has not yet been determined as to whether the method can be made quantitative. L. DE K.

Detection of "Saccharin" in Wines. By GIULIO MORPURGO (*Chem. Centr.*, 1897, ii, 531; from *Giorn. di Farm. di Trieste*, 1896, 1, 357).—The "saccharin" now occurring in commerce is not identical with the product sold some years ago, and does not give its reactions. To detect its presence in wine, 400 c.c. of the sample, after being mixed with talc and clean sand, is dried on the water bath, and the powdered residue extracted with 100 c.c. of a mixture of ether and light petroleum, 3 c.c. of phosphoric acid being added. The residue left on evaporating the ether is cautiously dissolved in aqueous soda, and the "saccharin" is then detected by its taste. L. DE K.

Estimation of Xanthine Bases in Urine. By ROBERT FLATOW and ALBERT REITZENSTEIN (*Chem. Centr.*, 1897, ii, 145—146; from *Deutsch. Med. Wochschr.*, 23, 354—357).—The authors state that if Salkowski's silver process gives correct results, the Krüger-Wulff copper method must be rejected, as this gives about seven times more xanthine bases than the other. L. DE K.

Separation of Strychnine from Brucine. By G. SANDOR (*Zeit. anal. Chem.*, 1898, 37, 132; from *Apoth.-Zeit.*, 1897, No. 2).—The mixture of alkaloids (0·2 gram) is warmed with just enough 10 per cent. sulphuric acid to dissolve it, and, after cooling, is treated with a solution of 2 grams of potassium permanganate in 100 c.c. of 10 per cent. sulphuric acid until just coloured; the brucine alone is thereby destroyed. The liquid is then made alkaline with ammonia, and shaken with a mixture of 20 grams of chloroform and 30 grams of ether; the filtered chloroform-ether solution leaves the strychnine on evaporation. M. J. S.

Estimation of Caffeine in Coffee. By ARTHUR FORSTER and RUDOLF RIECHELMANN (*Chem. Centr.*, 1897, ii, 436; from *Zeit. öffentl. Chem.*, 3, 235—236).—A reply to Juckenack and Hilger. When extracting an aqueous solution of caffeine with chloroform, there is no real need for adding aqueous soda, but the authors find that the chloroform layer separates more readily in the presence of soda; the latter has no decomposing action on caffeine. L. DE K.

Estimation of Urea by means of Formaldehyde. By CARL GOLDSCHMIDT (*Chem. Zeit.*, 1897, **21**, 586).—Thoms having tried the author's process of estimating urea by means of formaldehyde in an acid solution, concludes that it is impracticable. His analysis points to the condensation product being methyleneurea.

The author states that, on repeating his analysis, he has obtained the same results as before, and that Thoms' result is untrustworthy.

L. DE K.

Estimation of Tannin by means of Hide Powder. By JOHN H. YOCUM (*J. Soc. Chem. Ind.*, 1897, **16**, 419—420).—To secure results which are both uniform and in accord with the practical application of the materials to the production of leather, the following precautions are desirable. The hide should be freed from readily soluble substances by washing immediately before adding it to the tannin solution, a correction being made for the dilution caused by the adhering water. A mechanical means of shaking completes the tanning operation before there is time for the production of more soluble hide. The empirical method of filtration gives comparable results for the soluble solids and the adoption of 20° as the temperature for filtration removes a source of error. The filtrate must be tested for tannin and soluble hide; for the latter, a solution of tannin is a delicate reagent, whilst for the former, a solution of gelatin in dilute alcohol is more sensitive than an aqueous solution. To prepare this, 5 grams of gelatin is dissolved in 100 c.c. of warm water, 40 c.c. of 90 per cent. alcohol is added, and the precipitate is filtered at a temperature a few degrees below that of the atmosphere. It is of great importance that uniform quantities of hide, and solutions of uniform density should be employed in the estimations. The most serious cause of discordance is that different preparations of hide powder do not give the same result. M. J. S.

Formation of Hæmatin Crystals. By CASIMIR STRZYZOWSKI, *Chem. Centr.*, 1897, i, 295—296; from *Pharm. Post.*, **30**, 2—4).—In the production of Teichmann's hæmin crystals, sodium chloride may be replaced by sodium bromide or iodide. The hydrobromide and the hydriodide crystals have the same form as the hydrochloride but are darker coloured, being nut-brown and brownish-black respectively. As it seemed possible that the sodium chloride present in the blood might have taken part in the production of the crystals, the experiments were repeated with pure hæmatin; the same results were obtained.

The employment of sodium iodide is recommended for forensic purposes, as, owing to the darker colour of the crystals, as little as 0·000025 gram of fresh blood can be detected. N. H. J. M.

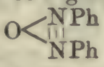
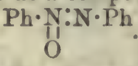
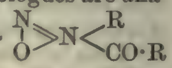
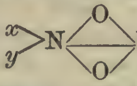
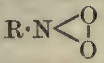
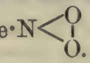
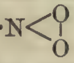
General and Physical Chemistry.

Atomic Refraction of Fluorine. By FRÉDÉRIC SWARTS ((*Chem. Centr.*, 1897, ii, 1042—1043; from *Bull. Acad. roy. Belgique*, 1897, [iii], **34**, 293—307).—Using the Lorenz formula and Conrady's values for the atomic refractions of carbon, hydrogen, and oxygen, the author has calculated the atomic refractions of fluorine, chlorine, and bromine in saturated and unsaturated compounds. The values obtained were, for chlorine, 5·9028 in saturated, and 6·001 in unsaturated compounds; for bromine, 8·762 in saturated, and 8·759 in unsaturated compounds; for fluorine, 1·082 in saturated, and 0·775 in unsaturated compounds. The difference between the two values is therefore far more pronounced with fluorine than with either chlorine or bromine. A possible explanation of this is, that fluorine in unsaturated compounds behaves as a polyvalent element, and that in those compounds the carbon atoms are no longer doubly linked. If this is the case, the true atomic refraction of fluorine in these compounds is 0·775 *plus* the value for the double linking, 1·707, and therefore 2·482. The atomic refraction of fluorine in saturated compounds is about equal to that of hydrogen, 1·051. If the double linking is present in the unsaturated fluorine compounds, in these fluorine has the smallest atomic refraction of any known element. This is in keeping with the fact that fluorine has also the smallest atomic volume. H. C.

Rotatory Power of Polymerised Compounds. By MARCELLIN P. E. BERTHELOT (*Compt. rend.*, 1897, **125**, 822).—In connection with the researches of Guye and Aston, the author calls attention to his early researches on the rotatory power of isoterebenthene ($[\alpha]_D = -10·0°$) and metaterebenthene ($[\alpha]_D = -3·3°$) (*Ann. Chim. Phys.*, 1853, [iii], **39**, 16), and styrene ($[\alpha]_D = -3·4°$) and metastyrene ($[\alpha]_D = -2·2°$) (Abstr., 1878, 296). C. H. B.

Flame Spectrum of Carbonic Oxide. By W. NOEL HARTLEY (*Proc. Roy. Soc.*, 1897, **61**, 217—219).—In the flame spectrum of carbonic oxide previously examined by the author (*Phil. Trans.*, 1895, **185**, A, 176), faint lines were observed, coincident with the edges of carbon bands present in the flame of coal gas. Since these might have been due to carbonaceous dust, or to traces of volatile hydrocarbons, the spectrum obtained under conditions which exclude the presence of such impurities has been examined, using a narrower slit than formerly, to ensure better definition. Whilst no carbon bands or lines were photographed, two groups of lines of the water-vapour spectrum (Liveing and Dewar, *Phil. Trans.*, **179**, 27) were observed, which were identified by comparing them with those obtained from the flame of an oxy-hydrogen blow-pipe. The same lines were also visible when both the oxygen and carbonic oxide had been carefully dried, although not present in the original photograph of the carbonic oxide spectrum (*loc. cit.*). In the latter case, their invisibility was probably due to the lack of definition caused by the wider slit. The lines probably owe their origin to the moisture of the atmosphere; their presence is, possibly, a confirmation of Dixon's observation (Trans., 1886, 94), that dry carbonic oxide will not burn in dry air, although Smithells (Trans., 1894, 610) states that it will burn if previously heated.

Since the relative intensities of the two groups of lines are not the same as in Liveing and Dewar's photographs, it is possible that they belong to the spectra of two different substances, one of which is possibly an oxide of nitrogen. W. A. D.

Spectrochemistry of Nitrogen. VI. Oxygen Compounds of Nitrogen. By JULIUS W. BRÜHL (*Zeit. physikal. Chem.*, 1898, 25, 577—650).—The spectrometric constants of the group $\cdot NO_3$ do not differ to any appreciable extent in the alkylic nitrates and nitric acid, whilst, further, the values for NO_2, obtained by comparison of the nitrates with the alcohols also agree, so that the constitution of these compounds must be regarded as similar to that of nitric acid. The value of the NO_2-group further agrees with that of the same group in the alkylic nitrites, but is considerably greater than in the nitro-compounds. Concordant values for the N_2O_2-group are obtained from the primary and secondary nitramines and the substituted nitro-urethanes, so that the author concludes that even if the group N_2O_2 is not identical in structure in the three classes of compounds, yet there can be no saturation difference, and similar results also hold for the NO_2-group. The nitroso-compounds are next examined, and the spectrometric constants for the NO and N_2O-groups determined for a number of nitrosamines; the values obtained agree well among themselves, but the results for NO do not agree with those obtained from the nitrites, probably owing to the influence of the oxygen in the latter compounds. In the hydrazines, although the values for N_2 differ considerably, yet those of the primary nitrogen alone agree well in all the compounds, being equal to the constants obtained for the nitrogen of hydroxylamine and ammonia. The refraction of the N_2 group in the diazo-compounds is 8·41, or about 3·4 higher than that of the same group in the primary hydrazines, whilst the refraction for N_3 in diazobenzeneimide is 10·37, that is, again 3·4 higher than that of three hydrazine nitrogens, so that the diazo-nitrogens have an undoubtedly higher value than those of hydrazine, the difference being considerably greater than that due to an ethylenic linking. The author then considers the bearing of these results on the question of the constitution of the various compounds. In azoxybenzene, the value for the N_2O-group is 11·9, whilst that calculated on the assumption of a single linking between the nitrogen atoms is 7·5, so that azoxybenzene must be regarded as a compound of the diazo-structure with the formula  $O<\begin{matrix}NPh\\ \vert\vert\vert \\ NPh\end{matrix}$ or  $\underset{\overset{\vert\vert}{O}}{Ph\cdot N:N\cdot Ph}$. For similar reasons, the author considers that nitrosoethylurethane and its homologues are analogous in structure to the diazo-compounds, the formula  $\begin{matrix}N\\ \vert\\ O\end{matrix}\!>\!N<\begin{matrix}R\\ CO\cdot R\end{matrix}$ being suggested. The constants obtained for nitrous oxide and free nitrogen do not lead, however, to any definite structural formulæ. The constitution of the nitramines is discussed at considerable length, various suggested formulæ are considered, that which is best in accord with the chemical and physical properties being  The comparison of the nitrites with the nitro-paraffins leads to the formulæ RO·N:O and  $R{\cdot}N{<}^{O}_{O}$ for these classes of compounds, the metallic nitrite possessing a constitution similar to that of the alkylic compounds. The formation of a nitro-paraffin from silver nitrite is hence explained, thus: $AgO{\cdot}N{:}O + MeI = AgO{\cdot}NMe{\cdot}O{\cdot}I = AgI +$  $Me{\cdot}N{<}^{O}_{O}$. As the refraction of the NO_2-group in the nitric acid and the nitrates differs from that in nitro-compounds, the group  ${\cdot}N{<}^{O}_{O}$ is absent in the nitrates, and as the complex $O{=}N{=}O$ should, on account of the two doubly-linked oxygens and a quinquivalent nitrogen, possess a much higher value than that actually found, the author concludes that this group is also absent, and that the formula best in accord with the spectrometric values is ·O·O·N:O, and the formation of nitro-compounds from nitric acid is explained on this assumption. The author further suggests that in nitric acid itself the union of the atoms is not rigid, so that the hydrogen is united with different oxygens in turn (Abstr., 1897, ii, 297). L. M. J.

Electromotive Behaviour of Chromium. By WILHELM HITTORF (*Zeit. physikal. Chem.*, 1898, **25**, 729—749).—In dilute halogen acids or sulphuric acid, chromium dissolves on the application of heat with the formation of chromous compounds; nitric, chloric, chromic, phosphoric, citric, tartaric, formic, and acetic acids; caustic potash and caustic soda have, however, no action either hot or cold. In its electrical properties it was found to be electronegative, not only to zinc, but also to cadmium, iron, nickel, copper, mercury, and silver, and is inactive in salt solutions of these metals except in that it reduces mercuric or cupric to mercurous or cuprous salts. When employed as anode in solutions in which it is indifferent, it was found to become covered with a yellow film of chromic acid, and the loss of weight of the anode was found to correspond with the production of sexavalent chromium ions; this occurs even in solutions of hydrogen chloride in which chromium ordinarily dissolves with the formation of chromous salts. This may be due either to the decomposition of the water by the anion and subsequent formation of chromic acid from the liberated oxygen, or to the formation of a compound of sexavalent chromium with the anion and the decomposition of this compound by water; no such compound, however, is actually known to exist. In solutions of potassium thiocyanate or of an iodide, the chromium anode experiences no loss. A chain of the type, $Cr \mid KCl \mid NaNO_3 \mid AgNO_3 \mid Ag$, gave no electromotive force at 5°, and the same result obtained when a dilute acid was used in place of the potassium chloride solution; when measured against 2 Daniells cells, an E.M.F. of 0·4D was obtained. When the acid employed, however, was sufficiently strong to cause dissolution of the chromium and evolution of hydrogen, an E.M.F. of 1·056 volts was found. When the metal was used for the electrolysis of melted potassium chloride or zinc chloride, totally different results were obtained, and the loss of weight of the anode proved that bivalent chromium ions were produced, and similar results were also found in solutions at 100°, of the halogen acids, of potassium chloride, cyanide, bromide, or iodide, of barium chloride or ammonium chloride, and in solutions of zinc or magnesium chloride at higher temperatures. In solutions of the salts of easily reducible metals, such as cadmium or copper, the chromium was still found to produce sexavalent ions. Corresponding with this change in the activity of the chromium, a change was also found in E.M.F. of the cell previously examined, the value of 1·05 volts being reached at 100°, when such a cell forms a constant galvanic element. In melted oxygen salts or in oxygen acids at 100°, sexavalent ions were still found to exist, so that the E.M.F. of a cell of the type $Cr \mid SO_4K_2 \mid NaNO_3 \mid NO_3Ag \mid Ag$ remains practically constant when raised to 100°. By the use of alcoholic solutions of zinc chloride, the tervalent ions were also obtained. The inactivity of the chromium is compared with the passive state of iron, but the author considers that the explanation assigned to the latter phenomenon, namely, the formation of a film of oxide, cannot apply to the former case. L. M. J.

Electromotive Behaviour of Cadmium Amalgams of Different Composition. By WILHELM JAEGER (*Ann. Phys. Chem.*, 1898, [ii], **64**, 106—110).—As cadmium cells are employed in place of zinc cells as standards in E.M.F. measurements, it is of importance to ascertain in how far their behaviour depends on the composition of the cadmium amalgam they contain. Direct measurements show that amalgams containing from 5 to 15 per cent. of cadmium exercise the same influence on the E.M.F., as this is not found to vary within one-hundredth of a millivolt. Amalgams containing more than 15 per cent. of cadmium do not give constant results, the E.M.F. rising gradually to that given by cadmium alone. An amalgamated cadmium rod is at first found to give the value obtained for the weak amalgams, but in a short time the E.M.F. rises in the direction of that of pure cadmium. This is evidently due to the diffusion of the mercury into the cadmium.

H. C.

Electrolysis of Hydrochloric Acid and Cathodic Formation of Lead. By FRITZ HABER (*Zeit. anorg. Chem.*, 1898, **16**, 438—449).—Electrolysis of hydrochloric acid with platinum or platiniridium electrodes is found to result in an attack of the platinum at ordinary temperature when the acid is concentrated, but the platinum remains unaffected when the concentration is below 30 per cent. HCl. Platiniridium containing 10 per cent. of iridium is hardly attacked at all by the concentrated acid, and if the alloy contains 20 per cent. of iridium it remains unaffected. At the boiling point, an 11 per cent. acid solution attacks the platinum as vigorously as a 36 per cent. solution at the ordinary temperature, but an 8 per cent. solution leaves the platinum intact. During the course of the electrolysis, a deposition of platinum on the cathode is observed, but this is not due to transference of platinum from the anode to the cathode, as the cathode loses in weight. It is probably due to mechanical action and in some way connected with the absorption of gases by the platinum. Lead is found to behave in a similar manner, so that formation of a layer of spongy lead on the cathode can be obtained by the electrolysis of sulphuric acid with lead electrodes. H. C.

Electrolysis of Hydrochloric Acid. II. By FRITZ HABER and S. GRINBERG (*Zeit. anorg. Chem.*, 1898, **16**, 329—361. Compare this vol., ii, 215).—In continuing their investigation of the electrolysis of hydrochloric acid, the authors have made experiments with acid to which either sodium hydroxide or magnesia had been added in sufficient quantity to effect a neutralisation of two-thirds of the acid ; they have also carried out investigations with the pure dilute acid at 100°. The presence of sodium hydroxide or magnesia has little effect on the evolution of oxygen from the dilute acid. Heating the acid brings about a most marked increase in the evolution of oxygen, which was found in one case to constitute 88·2 per cent. of the gas from the anode. The amount of chloric acid formed is, however, decreased to mere traces, unless the acid is largely diluted with water. Perchloric acid is also found in very small quantity. A full theoretical disscussion is given by one of the authors. (F. H.). H. C.

Migration Constants of Zinc and Cadmium Salts in very Dilute Solutions. By GOTTFRIED KÜMMELL (*Ann. Phys. Chem.*, 1898, [ii], **64**, 655—679).—The author finds that limiting values for the migration constants of zinc and cadmium salts can be directly determined with the haloid compounds when the dilution is $\frac{1}{100}$ to $\frac{1}{500}$ normal, and that these values are in keeping with the Kohlrausch law. The sulphates, however, appear to contain complex ions of the character $S_4\bar{O}ZnS\bar{O}_4$, and therefore do not give results consistent with the Kohlrausch law in these dilutions. Combining his results with the conductivity determinations of Wershofen and Kohlrausch, the author gives the following apparent rates of transference *U* and *V* for the positive and negative ions respectively, the concentrations, *c*, being given in equivalents per litre.

c.	$\frac{1}{2}CdCl_2$.			$\frac{1}{2}CdBr_2$.			$\frac{1}{2}CdI_2$.			$\frac{1}{2}ZnCl_2$.		
	$\lambda\,10^7$	$U\,10^7$	$V\,10^7$	$\lambda\,10^7$	$U\,10^7$	$V\,10^7$	$\lambda\,10^7$	$U\,10^7$	$V\,10^7$	$\lambda\,10^7$	$U\,10^7$	$V\,10^7$
0·002	94	39	54	92	39	53	86	39	47	98	39	59
0·005	85	36	49	80	34	46	72	32	40	—	—	—
0·006	—	—	—	—	—	—	—	—	—	94	38	55
0·01	77	32	45	71	30	41	61	27	33	91	37	54

H. C.

Electrostenolysis. By ALFRED COEHN (*Zeit. physikal. Chem.*, 1898, **25**, 651—656).—From the law that when two dielectrics are in contact, that with the higher dielectric constant becomes positive to the other, it follows that water, owing to its very high constant, becomes

positive to the walls of the containing vessel, and hence the metallic ions form a layer on the wall and the acid ions the corresponding film of the 'double layer.' The quantity of metal so precipitated is too small to be visible, but in the case of a layer so formed in a crack in the partition separating two similar solutions containing electrodes, the quantity may be increased if the addition at the cathodic end exceeds that dissolved at the anodic end, in which case Braun's "electrostenolysis" (Abstr., 1891, 393) will occur. This happens: (1) when the negative radicle does not act on the precipitated metal; (2) when insoluble compounds, usually peroxides, form at the anode; (3) when the negative ion reacts with the solution to form salts of a higher oxide; and the author points out that all the cases of electrostenolysis observed by Braun are due to one or other of these causes.
L. M. J.

Determination of the Conductivity of Liquids in Thin Layers. By G. B. Bryan (*Phil. Mag.*, 1898, [v], **45**, 253—272).—According to Koller (*Wien. Ber.*, 1889, **98**, ii*a*, 201), the specific conductivity of certain liquids decreases as the thickness decreases. By careful repetition of Koller's experiments with new and improved apparatus, the author has been able to prove that for dilute solutions, alcohol and aniline, the conductivity is the same for all thicknesses within the limits of the experiments. It has been found that the great differences obtained by Koller for water and alcohol can be eliminated by taking care that the plates are true and clean, and by using an alternate current instead of a continuous one. H. C.

Calculation of the Conductivity of Aqueous Solutions Containing Two Electrolytes with no Common Ion. By James G. MacGregor and E. H. Archibald (*Phil. Mag.*, 1898, [v], **45**, 151—157).—According to the dissociation theory, the specific conductivity of a complex solution, volume v of which contains N_1, N_2, N_3, &c., gram equivalents of the electrolytes 1, 2, 3, &c., respectively, is given by the expression, $\frac{1}{v}(\alpha_1 N_1 \mu_{\infty 1} + \alpha_2 N_2 \mu_{\infty 2} + \alpha_3 N_3 \mu_{\infty 3} + \&c.)$, where the α's are the coefficients of ionisation of the electrolytes and the μ_{∞}'s their specific conductivities per gram equivalent at infinite dilution. It is shown how equations sufficient for the determination of the α's and N's may be obtained for solutions containg two electrolytes with no common ion. A series of observations and calculations of the conductivity of solutions containing sodium and potassium chlorides and sulphates was made to test the results. The agreement between the observed and calculated values in the case of the more dilute solutions is satisfactory. H. C.

New Basis for the Values of the Conductivities of Electrolytes. By Friedrich Kohlrausch, L. Holborn, and H. Diesselhorst (*Ann. Phys. Chem.*, 1898, [ii], **64**, 417—455).—The object of this investigation was to obtain accurate determinations of the conductivities of a number of normal electrolytes, and to employ these values for the purpose of revising the older data with reference to conductivities, as well as to furnish numbers that might be used as standards in future determinations. The unit of conductivity selected is that of a substance of which 1 centimetre cubed has a resistance of 1 ohm. This conductivity is denoted by κ, and the conductivity in electromagnetic units is therefore $\kappa.10^9$. Solutions of strong monobasic acids, which have the greatest conductivity, would approximate to the above unit conductivity at 38—40°. At the ordinary temperature, accumulator sulphuric acid has a value of about 0·7; concentrated copper sulphate, 0·05; concentrated sodium chloride, 0·2; and good distilled water 10^{-6}. For mercury at 0°, $\kappa = 10630$.

The following values were obtained for the standard electrolytes examined.

Sulphuric acid, of maximum conductivity, density 18°/4° = 1·223, containing about 30 per cent. H_2SO_4, $\kappa_{18} = 0·7398$.

Magnesium sulphate, of maximum conductivity, density 18°/4° = 1·190, about 35·6 per cent. $MgSO_4$, $\kappa_{18} = 0·04923$.

Sodium chloride, saturated solution, $\kappa_{18} = 0·21605$.
Potassium chloride, normal solution, $\kappa_{18} = 0·09822$.
,, ,, $\frac{1}{10}$,, ,, $\kappa_{18} = 0·01119$.
,, ,, $\frac{1}{50}$,, ,, $\kappa_{18} = 0·002397$.
,, ,, $\frac{1}{100}$,, ,, $\kappa_{18} = 0·001225$.

Experiments were made at temperatures between 0° and 36°, in order to determine accurately the influence of temperature on the conductivities of the above solutions. The results are given in tabular form.

To convert values obtained in the older determinations, and expressed in mercury units k into the units now employed, they should theoretically be multiplied by the factor 10630. But as several sources of error, as, for example, in the temperature measurements, are known to exist, it would appear that the value of the factor for the determinations of Kohlrausch and Grotian, Kohlrausch, Loeb, and Nernst, MacGregory, and Sheldon is about 10691. For determinations made in Ostwald's laboratory, the factor 10660 may be taken. H. C.

Determination of the Boiling Point of Aqueous Solutions with Beckmann's Apparatus. By WILHELM MARCKWALD and A. CHWOLLES (*Ber.*, 1898, 31, 791—795).—More concordant results were obtained than are commonly supposed to be attainable; the following precautions were observed. (1) Two apparatus were used. Water was first boiled in both, and the difference between the readings of the two thermometers was noted. The water in one was then replaced by the solution to be examined, and the difference between the two thermometers again noted. By subtracting the first difference from (or adding it to) the second, the raising of boiling point in the solution is obtained, free from any error that variation of the atmospheric pressure might otherwise have introduced. (2) For a month before use both thermometers were heated each day to 120—160° in glycerol and allowed to cool slowly during the night; this treatment was necessary in order to secure a constant difference between the two thermometers when both were immersed in boiling water. In each separate series of determinations, the difference between the readings of the two thermometers varied at most by ± 0·004° to 0006°, whilst the raising of the boiling point varied in the different series from 0·065° to 0·165°; the solutions experimented with were those of cinchonine hydrogen *d*-tartrate and *l*-tartrate.

The boiling vessel is best made of Jena glass with a thin platinum wire fused into the bottom; those of Thuringian glass, with a thick wire, crack very soon. The apparatus is heated very cautiously with a ring-burner slightly larger in diameter than the porcelain mantle, and finally a long, thin, smoky flame is lighted under the boiling vessel; $1\frac{1}{4}$—$1\frac{1}{2}$ hours elapses before the temperature becomes constant. C. F. B.

Heat of Separation in Solutions: Freezing Point Reduction: Solubility. By Albert Dahms (*Ann. Phys. Chem.*, 1898, [ii], **64**, 507—518).—By "heat of separation," the author denotes all heat changes which accompany the removal of one of the constituents from a solution, as heat of vaporisation or solidification of the solvent. Thermodynamical considerations lead to the general law of solubility enunciated by Schröder (Abstr., 1893, ii, 366), and Le Chatelier (Abstr., 1894, ii, 272). A satisfactory agreement with the theory is obtained for solutions of ethylenic bromide in naphthalene, ethylenic bromide and benzene in diphenylamine, and diphenylamine in ethylenic bromide. Exceptions are observed in other cases, and these the author refers in the first place to the influence of temperature on the latent heat of fusion. If the latent heat of fusion, r, changes with temperature, so that $r = r_0 + a(t_0 - t)$, the Schröder-Le Chatelier formula then becomes

$$\log s = \frac{r_0 + \frac{a}{2}(t_0 - t)}{R}\left(\frac{1}{t} - \frac{1}{t_0}\right)$$

H. C.

Determinations of the Freezing Point Reductions of Dilute Solutions and their Relation to the Theories of Solutions. By Richard Abegg (*Ann. Phys. Chem.*, 1898, [ii], **64**, 486—506).—A critical examination of the determinations of the freezing point reductions of dilute aqueous solutions which have been made by Raoult, Jones, Loomis, Nernst and Abegg, Wildermann, and Ponsot, leads the author to conclude that the more trustworthy the method adopted and the results obtained, the closer the agreement between these results and those required by the theories of Van't Hoff and Arrhenius. The vapour pressure determinations of Dieterici (*Ann. Phys. Chem.*, 1897, [ii], **62**, 616), are also criticised, and the want of agreement between the results obtained and those required by the above theories is shown to be probably due to experimental error. H. C.

Thermochemistry of Hydrobenzamide Amarine, and Lophine. By Marcel Delépine (*Compt. rend.*, 1897, **125**, 178—181).—Amarine crystallises with $\frac{1}{2}H_2O$, and in this hydrated form melts at 100°; when anhydrous, it melts at 129°.

	Heat of combustion		Heat of formation.	Heat of solution and of neutralisation.
	(1) At constant volume.	(2) At constant pressure.		
Hydrobenzamide ……	2666·1 cal.	2668·1 cal.	−66·8 Cal.	
Hydrated amarine……	2651·2	2653·2	−51·9	4·8 Cal.
Anhydrous ,, ……	2651·4	2653·4	−52·1	6·1
Lophine ………………	2585·85	2587·6	−55·3	

$3C_6H_5CHO$ liq. + $2NH_3$ diss. = $(C_6H_5CH)_3N_2$ sol. + $3H_2O$ (liq.) + 2×11 Cal.

$C_{21}H_{18}N_2$ (amarine) sol. + O = $C_{21}H_{16}N_2$ sol. + H_2O liq. + 66·6 Cal.

J. J. S.

Determination of the Molecular Weight of Solid Substances. By Isidor Traube (*Ber.*, 1898, 31, 1081—1083. Compare this vol., ii, 213).—The author, in reply to the criticism of Fock (this vol. ii, 284), maintains the accuracy of his previous deduction that most solid compounds have twice the molecular weight usually ascribed to them. He also points out that Fock is not justified in applying the equation $c\frac{(1-\gamma)}{x} + \frac{c\gamma}{\sqrt{x}} = \text{const.}$ to strong electrolytes, in the way in which he has employed it in his method for determining the molecular weights of solid substances (Abstr., 1897, ii, 481; this vol., ii, 154).

A. H.

Supersaturation and its Dependence on Crystalline Form. By William W. J. Nicol (*Zeit. anorg. Chem.*, 1897, 15, 397—404).—The author advances the view that when, under the conditions of the experiment, two allotropic modifications of the dissolved or molten substances are capable of existing, the occurrence of supersaturation or superfusion becomes possible. By allotropic is here understood not merely amorphous and different crystalline forms of the same substance, but such different crystalline modifications as may owe their existence to the presence or absence of water of crystallisation, or other foreign molecules. Thus a supersaturated solution of sodium thiosulphate deposits, on evaporation at ordinary temperature, not only crystals containing $5H_2O$, but also crystals which probably contain $2H_2O$. Sodium sulphate, as is well known, gives both the decahydrate and a heptahydrate. Borax can be obtained either as decahydrate or pentahydrate, and similar allotropic forms were observed with barium chloride and lead acetate. The deposition of different allotropic crystalline forms from supersaturated solutions was observed with the nitrates of potassium, ammonium, and silver, and among organic compounds with acetanilide, quinol, acetamide, resorcinol, and malonic, mandelic, tartaric, and citric acids.

H. C.

Crystallisation of Overcooled Benzophenone. By Karl Schaum (*Zeit. physikal. Chem.*, 1898, 25, 722—728).—The author had previously observed that benzophenone contained in various tubes which had been heated for some time above its melting point, solidified at different temperatures, although the tubes were all treated alike, and, therefore, considered it probable that the nature of the surface in contact with an overcooled liquid affects the temperature of solidification. To test this, 62 tubes of benzophenone were prepared, and in about 30 were placed small pieces of glass, pumice, or marble, garnets, sand, &c., whilst the interior of some of the tubes was previously etched by hydrogen fluoride or coated with fat. The tubes were then kept at 52° for 30 minutes and allowed to cool, the temperature being noted at which solidification occurred in each tube. The effect of the added substance is, in general, to increase the tendency to solidify, the sand having the most marked effect. Repeated melting diminishes this tendency, as in the first series of experiments 40 tubes, and in the sixth series only 10 tubes, solidified at the temperature of the air. Long heating and very gradual cooling favour the overcooling, and at low temperatures produced by carbonic anhydride and ether the benzophenone solidifies to a glassy mass. In all the experiments, the stabile modification of the compound was alone obtained. L. M. J.

The Equilibrium, $CO + H_2O \rightleftharpoons CO_2 + H_2$, and the Study of Explosives. By C. Hoitsema (*Zeit. physikal. Chem.*, 1898, **25**, 686—698).—In most cases of the combustion of explosives in insufficient oxygen, the chief products of the reaction are carbonic anhydride, carbonic oxide, water, and free hydrogen, so that at the temperature of the explosion these gases are in equilibrium, and from the quantities of the several components, the equilibrium constant may be calculated for the reversible reaction, $CO + H_2O \rightleftharpoons CO_2 + H_2$. At ordinary temperatures, the velocity in either direction is practically zero, but at 600° the direct action, $CO + H_2O \rightarrow CO_2 + H_2$, becomes measurable, although the reverse action cannot be observed below about 900° (Naumann and Pistor, Abstr., 1886, 16, 120). From the results of Macnab and Ristori's (Abstr., 1895, ii, 434) determinations of the composition of the gaseous products, and of the heat produced by different explosives, the author calculates the temperature of the explosion and the equilibrium constant for the above reaction; this constant is found to increase with temperature from about 4 at 2200° to 5 at 2800°. From Horstmann's researches on the incomplete combustion of mixtures of carbonic oxide and hydrogen, further data are obtained for the determination of the constant, and in each set of experiments a maximum value is indicated at a temperature varying from 2500° to 2900°, the mean being 6·25 at 2670°. This maximum value should occur at the temperature at which the heat development is zero, and by the aid of Mallard's and Le Chatelier's formulæ for the specific heats of the various gases, this temperature is calculated to be 2825°, a number lying between that indicated by the two sets of determinations, which the author considers agree as well as could be expected, many factors, the dissociation of the product, for instance, not being determined. L. M. J.

The author makes no mention of Dixon's determinations of the equilibrium constant, nor of any of the same author's numerous researches on this subject (Trans., 1886, 94; Abstr., 1885, 479).

L. M. J.

Explanation of the Exceptions observed in the Speed of Chemical Changes in Solution. By Ernst Cohen (*Chem. Centr.*, 1897, ii, 460; from *Maandbl. Natuurw.*, 1897, 21, 47—53).—The rate of inversion of cane-sugar is, according to Ostwald, given by the equation $K = \frac{1}{t} \log \frac{A}{A - x}$, where t is time, A the amount of sugar originally present, and x the amount that has undergone change in the time t.

Exceptions are, however, observed from this, the normal behaviour. Thus, when $A = 40$ per cent., $K = 29{\cdot}16$, but when $A = 4$ per cent., K is only 19·15. The exceptions are due to the volume of the sugar being left out of consideration; for if the amount of acid is the same in both cases, the volume in which sugar molecules and acid molecules meet is smaller in the case of a 40 per cent. than with a 20 per cent. sugar solution, and, consequently, the rate of inversion is greater. In this case $K_{40} : K_{20} = 1/(100 - b_{40}) : 1/(100 - b_{20})$, where b_{40} and b_{20} are the volumes occupied by 40 and 20 grams of sugar respectively in the solution. Or, for the general case, $K_p : K_q = C_p/(100 - b_p) : C_q/(100 - b_q)$, where C_p and C_q are the concentrations of the acid. The author has tested these equations experimentally, and finds that they hold.

H. C.

Separation of Racemic Compounds by means of Optically Active Substances. By Wilhelm Marckwald and A. Chwolles (*Ber.*, 1898, 31, 783—790).—There are still adherents to Pasteur's opinion that, if racemic acid can be separated into *r*- and *l*-tartaric acids by crystallisation of its quinine, but not of its potassium, salt; if, that is, "quinine does not behave in the same way with respect to the two tartaric acids as potash does, this is only because it is asymmetrical, whilst potash is not. Asymmetry is thus a property which is in itself capable of altering chemical affinity." Now it is opposed to modern views of affinity that two acids which have an identical constant of affinity with respect to one base, potash, should have different constants with respect to another base, quinine. In fact, the authors find that *r*- and *l*-tartaric acid have an identical constant of affinity in respect to both cinchonine and nicotine, which are both optically active, and, therefore, asymmetrical; for solutions of equivalent strength of the cinchonine hydrogen salts of these two acids exhibit a raising of the boiling point of the water by the same amount; and the methylic salts of the two acids are hydrolysed at the same rate by nicotine, both at 17·5° and at 40° (decinormal aqueous solutions of the two reacting substances were mixed in equal proportions by volume).

The following explanation is adopted. The potassium salts of two optically isomeric acids are, like the acids themselves, images of each other in a mirror; they would, therefore, not be expected to have different solubilities, nor, in consequence, to be separable by crystallisation; but when the two acids form salts with an optically active base, the two compounds formed, each of which now contains two asymmetric systems, are no longer related as object to image, and might, therefore, be expected to exhibit a difference in solubility such as would render it possible to separate them by crystallisation. It is this physical difference between the two salts that determines the possibility of separation, not a difference in the extent of chemical action of the two acids on the base; for, when inactive methylethylacetic acid, or inactive mandelic acid, is treated with (optically active) brucine, in amount just sufficient to neutralise half of the acid, *care being taken that enough water is present to keep the brucine salt dissolved*, the acid that can be removed from the solution by extraction with ether is found to be optically inactive. No separation into optically active constituents has been effected by the purely chemical action of the optically active base; it is only when physical differences come into play, such as the difference of solubility manifested in the one salt crystallising out before the other, that a separation of the constituents is attained.

Incidentally, *normal cinchonine* l-*tartrate* was prepared; like the *r*-isomeride, it crystallises with $2H_2O$, and both substances are partially decomposed by water into cinchonine and the hydrogen tartrate.

C. F. B.

Hylotropically Isomeric Substances. By Karl Schaum (*Annalen*, 1898, **300**, 205—228).—The term "hylotropic" has been proposed by Ostwald to denote such substances or mixtures of substances as are capable of undergoing change into others in such a manner that the elementary composition of the original substances is the same as that of the products of reaction. Thus, the substances standing on either side of a chemical equation are hylotropic. All compounds which may change directly into isomeric compounds are hylotropically isomeric. These may be divided into two groups: physically isomeric hylotropic substances, in which the isomerism depends on a difference in the energy content, and chemically isomeric hylotropic substances, which owe their difference to differences in the chemical molecules. Physically isomeric substances are always hylotropic, but this is not true of chemical isomerides. Polymorphous substances are physically isomeric, and form the main class of hylotropic substances of this order; in the liquid state, experiments, which the author quotes, with hexachlor-α-keto-β-R-pentene show that the physical isomerism which holds for the solid (see Küster, Abstr., 1896, ii, 158) is not maintained. Chemical hylotropism is most frequently due to polymerisation and dissociation. Some special cases are discussed by the author.

H. C.

Condensation of Water Vapour in Presence of Dust-free Air and other Gases. By C. T. R. Wilson (*Proc. Roy. Soc.*, 1897, **61**, 240—242).—When air, oxygen, nitrogen, chlorine, or carbonic anhydride, initially saturated with moisture, and free from all foreign nuclei, is allowed to expand suddenly, a rain-like condensation takes place if the expansion exceeds a certain critical limit; on increasing the expansion, a second definite limit is reached, beyond which the condensation is cloud-like, the number of drops formed increasing at a very rapid rate with increasing pressure. In the case of hydrogen, the cloud-like condensation alone takes place.

Values are given for the limits of expansion and supersaturation which correspond with the two forms of condensation; these are apparently the same for all the gases examined except hydrogen, which, however, shows the cloud-like condensation at the same limit as the other gases. The Röntgen rays have the effect of greatly increasing the number of drops during condensation, the minimum expansion required for the latter remaining unaltered.

W. A. D.

Lecture Experiments. By JOHN WADDELL (*Chem. News*, 1898, **77**, 131).—Attention is drawn to the colour changes produced by solvents; alcohol or acetone causes the colourless solution of cyanine in acetic acid to turn blue; the red solution of methyl-orange in acetic acid to become yellow; acetone also changes the red solution of corallin in concentrated ammonia to yellow; all these changes are reversed by the addition of water, but again restored by the further addition of alcohol or acetone. The green colour of an ammoniacal solution of paranitrophenol is rendered lighter by adding concentrated ammonia and acetone, and is discharged by a further addition of ether: alcohol or, more especially, water, restores the green colour. A concentrated solution of phenolphthalein in acetone is scarcely coloured by strong ammonia, but a further addition of water develops the characteristic red colour. D. A. L.

Laboratory Notes. Asbestos. Combustion Furnaces. By H. JERVIS (*Chem. News*, 1898, **77**, 5—6).—The author draws attention to the facility with which asbestos may be moulded when wet, retaining the form so given to it when dried, these properties can be applied to the preparation of asbestos plugs, tips for burners, and arched and perforated covers for the combustion furnace; the diminished weight in the latter case, as compared with tile covers, permits of a much lighter structure for the furnace itself, and the author proposes the use of a piece of sheet iron suitably shaped for the purpose. D. A. L.

Inorganic Chemistry.

Hyponitrous Acid. By A. KIRSCHNER (*Zeit. anorg. Chem.*, 1898, **16**, 424—437. Compare Divers and Haga, Trans., 1889, 760; 1894, 529).—Hyponitrous acid is prepared as follows. Potassium oxyimidosulphonate (50 grams) is dissolved in boiling water (35 c.c.) and then, after cooling with ice, mixed with concentrated sodium hydroxide (1 : 1, 10 c.c.), care being taken that the temperature does not exceed 30°. The mixture is cooled to 10°, and 90 c.c. more of the sodium hydroxide added, the mixture heated at 50° for $\frac{1}{2}$ to $\frac{3}{4}$ hour and then poured into a litre of water. The resulting solution contains sulphate, sulphite, and hyponitrite, together with small quantities of undecomposed oxyamido-salt and hydroxylamine. The last two compounds are destroyed by the addition of yellow mercury oxide and the clear filtered solution made up to 4 litres and precipitated with silver nitrate as long as a light yellow precipitate of silver hyponitrite is obtained. The precipitate is finally washed with warm water until the wash water is neutral.

Barium, strontium, and calcium hyponitrites, $Ba(NO)_2 + 4H_2O$; $Sr(NO)_2 + 5H_2O$, and $Ca(NO)_2 + 4H_2O$, are obtained by adding the corresponding nitrates to a strongly alkaline solution of the silver salt. The precipitates are washed with alcohol and ether and dried on filter paper. The calcium salt is the most stable; it is not decomposed by carbonic anhydride at the ordinary temperature, and loses its water of crystallisation with difficulty. The strontium salt cannot be obtained anhydrous by drying at 100°. All three salts are slightly soluble in water, give an alkaline reaction, and when treated with dilute acids evolve nitrous oxide.

Lead Hyponitrites.—The *basic* salt, $PbO,Pb(NO)_2$, which is obtained as a yellowish-white precipitate, on adding lead acetate to an alkaline solution of the sodium salt, can be purified by dissolving it in acetic acid and precipitating with ammonia; when treated with acetic acid, it yields lead acetate and the normal salt, $Pb(NO)_2$, which is a yellow, crystalline powder. Both salts are insoluble in water, but dissolve easily in dilute acids and are precipitated as basic salt by the addition of sodium hydroxide or ammonia. When heated, the basic salt decomposes violently, whilst the normal salt explodes; the basic salt is also quickly decomposed by exposure to light.

Copper hyponitrite, $Cu(NO)_2,Cu(OH)_2$, obtained by adding copper sulphate to a solution of the sodium salt and subsequently precipitating by neutralising with ammonia, is a green, amorphous powder insoluble in water, but soluble in dilute acids and ammonia, is stable at 100°, yields copper oxide when strongly heated, and is very hygroscopic.

Silver hyponitrite, $Ag_2(NO)_2$, separates in small crystals from a solution in concentrated ammonia; it is easily soluble in dilute nitric or sulphuric acid, and in concentrated ammonia, and is at once decomposed by dilute hydrochloric acid into the free acid and silver chloride. It is slowly decomposed on exposure to light, or when heated at 100°; when heated in the air, or in carbonic anhydride, it yields red vapours of nitrous oxide and becomes black.

The free acid does not set free iodine from potassium iodide, nor does it decolorise a solution of iodine. With bromine, it is quickly oxidised to nitric acid, but the reaction is not a quantitative one, and with the calcium, barium, strontium and silver salts from 7·0 to 7·8 atoms of bromine are required for 1 mol. of salt.

When treated with potassium permanganate, only one atom of oxygen is absorbed, with formation of the compound $H_2N_2O_3$.

E. C. R.

Hyperborates and Hypertitanates. By Petr G. Melikoff and L. Pissarjewsky (*Ber.*, 1898, 31, 953—956. Compare this vol., ii, 332).—*Ammonium hyperborate*, $NH_4BO_3 + \frac{1}{2}H_2O$, is obtained when boric acid is dissolved in aqueous hydrogen peroxide solution (2·5 per cent.) and ammonia is added; and is deposited in colourless isotropic crystals on the addition of alcohol. In the dry state, it is quite stable, and even when kept over sulphuric acid it does not lose ammonia. When treated with dilute sulphuric acid, it gives hydrogen peroxide, but with concentrated acid it gives ozone, and with hydrochloric acid, chlorine. Its aqueous solution readily decomposes and evolves oxygen; this decomposition proceeds more rapidly at 45°, ammonium nitrite being formed. The freshly prepared salt contains $3H_2O$, but when kept for 24 hours over sulphuric acid, the salt containing $\frac{1}{2}H_2O$ is formed.

Barium hyperborate, $Ba(BO_3)_2 + 7H_2O$, is obtained by double decomposition from a saturated solution of the sodium salt cooled to 0°, in the form of a sparingly soluble, flocculent precipitate; it decomposes slowly at the ordinary temperature. The *calcium*, *copper*, and *nickel* salts have also been prepared. Cobalt chloride reacts with the sodium salt evolving oxygen, and yielding cobalt hyperoxide, CoO_2,CoO.

Normal sodium peroxide hypertitanate, $Na_2O_2,TiO_3 + 3H_2O$, which is formed when pertitanic anhydride is treated with hydrogen peroxide and sodium hydroxide ($TiO_3 : NaOH = 1 : 2$), separates on the addition of alcohol as a heavy oily layer which gradually solidifies to a yellow powder when placed over sulphuric acid. When treated with dilute sulphuric acid, it yields hydrogen peroxide.

Ammonium peroxide hypertitanate, $(NH_4)_2O_2,TiO_3,H_2O_2$, obtained in a similar manner, forms glistening, yellow prisms, is fairly stable in the dry state, but rapidly decomposes when in solution. When heated over a free flame, it explodes feebly.

Normal barium peroxide hypertitanate, $BaO_2,TiO_3 + 5H_2O$, was obtained as a yellow, flocculent precipitate. J. J. S.

Attempt to cause Helium or Argon to pass through Red-hot Palladium, Platinum, or Iron. By WILLIAM RAMSAY and MORRIS W. TRAVERS (*Proc. Roy. Soc.*, 1897, 61, 267).—Unlike hydrogen, neither argon nor helium is able to pass through a thin sheet of palladium, platinum, or iron, even when the latter is strongly heated in the blow-pipe flame. This would imply their inability to form any compound, however unstable, with these metals, or to dissolve in them at a red-heat, and is another proof of their inertness. W. A. D.

Experiments with Helium. By MORRIS W. TRAVERS (*Proc. Roy. Soc.*, 1897, 60, 449—453).—On passing a discharge through a Plücker tube containing helium at 3 mm. pressure, and fitted with platinum electrodes, a reddish-yellow glow is produced, which gradually changes, through shades of yellow and green, to the phosphorescent glow characteristic of a vacuum. These colour-changes are due to the gradual absorption of the helium by the platinum sparked on to the walls of the tube; on carefully heating the latter, the helium is evolved, and the colour-changes become visible in the reverse order. When the green glow is most intense, the best defined line is that in the green at $\lambda = 5015{\cdot}6$; if at this point the gas remaining unabsorbed by the platinum is completely removed by an air-pump, and the tube gently heated, the absorbed portion is evolved, and the greenish glow reproduced. It appears, therefore, that the latter is not due to the more difficultly absorbed fraction of the helium, but must be attributed solely to the lowering of the pressure consequent on the absorption.

Although hydrogen, nitrogen, and carbon compounds, as well as helium, are, more or less easily, absorbed when sparked with platinum electrodes, argon is only taken up in very small quantity; advantage can be taken of this to separate argon from helium, even when the amount of the latter is only 2 per cent. The mixture of gases is circulated during 6 hours, at 3 mm. pressure, by means of a Sprengel's pump, through a Plücker vacuum-tube kept cool by means of a water-jacket; on exhausting, and subsequently heating the vacuum-tube, helium containing only a trace of argon is obtained.

Kayser and Friedländer's statement (*Chem. Zeit.*, 9, 1529), that atmospheric argon is absorbed by platinum electrodes during a discharge and that certain of the helium lines then become visible, is, in the author's opinion, incorrect. W. A. D.

Barium Sulphide. By A. MOURLOT (*Compt. rend.*, 1898, **126**, 643—646).—Crystallised barium sulphide, BaS, is obtained by fusing the amorphous sulphide in the electric furnace with an arc from a current of 900 ampères and 50 volts, or by heating a mixture of the sulphate and carbon in a similar arc for a few minutes. It forms somewhat large, white crystals, with two very distinct planes of cleavage at right angles to one another; sp. gr. about 4·3; hardness, below that of glass. In general properties, the crystallised sulphide resembles the amorphous compound, but it is less readily attacked by air and various reagents. Fluorine attacks it with incandescence in the cold; oxygen attacks it with incandescence on heating. Potassium chlorate, lead peroxide, and other oxidising agents, as well as phosphoric anhydride and phosphorus oxychloride, also attack it with incandescence. When heated with carbon in the electrical furnace, it is converted into the carbide, Ba_2C. C. H. B.

Copper Ammonium Sulphate and Copper Ammonium Chloride. By LUIGI SABBATANI (*Chem. Centr.*, 1897, ii, 610—611; from *Ann. Chim. Farm.*, **26**, 337—350).—The author gives an account of the poisonous properties and the therapeutic application of these salts. After drying in a vacuum under various conditions, the composition corresponded with the formulæ $CuSO_4,4NH_3 + H_2O$ and $CuCl_2,4NH_3 + 2H_2O$ respectively. Both salts lose water and $2NH_3$ even at 100—110°, and very readily at 125°. The chloride is less stable than the sulphate, and gives up half its content of ammonia and water of crystallisation on warming, or if kept in a vacuum over sulphuric acid, or when exposed to the air, much more readily than the sulphate. When dried over lime, in presence of ammonia, the chloride loses all its water but no ammonia. The author is of the opinion that the sulphate, like the chloride, may also crystallise with $2H_2O$, although only $1H_2O$ is retained. E. W. W.

Solubility of Cerium Sulphate in Water. By WILHELM MUTHMANN and H. RÖLIG (*Zeit. anorg. Chem.*, 1898, **16**, 450—462).—Pure cerium sulphate, $Ce_2(SO_4)_3$, yields a clear solution when shaken with ice-cold water. The authors could only obtain three hydrates by dissolving this salt in pure water; they were not able to obtain the hydrates with 6 and $9H_2O$. The hydrate with $5H_2O$ is obtained in neutral solution at temperatures above 74°, and crystallises in beautiful, monoclinic prisms. The hydrate, with $8H_2O$, is obtained between 30° and 74°, and crystallises in rhombic pyramids. The hydrate, with $12H_2O$, is obtained by dissolving 20 parts of the sulphate in ice-cold water and separates in very slender needles.

The solubility of the pentahydrate in 100 parts of water varies from 0·775 parts at 100° to 8·20 parts at 40°. Below 40°, it is converted into the octohydrate. The solubility of the octohydrate varies from 19·10 parts at 0° to 4·24 parts at 70°. The solubility of the dodecahydrate varies from 21·40 parts at 0° to 16·22 parts at 25°. Above 25°, it is converted into the octohydrate. Curves of the solubilities are given in the original paper. E. C. R.

Atomic Weight of Aluminium. By JULIUS THOMSEN (*Zeit. anorg. Chem.*, 1897, **15**, 447—453).—The method adopted by the author for determining the atomic weights of oxygen and hydrogen (Abstr., 1896, ii, 244), by dissolving a known weight of aluminium in potassium hydroxide, and determining the weight of the hydrogen evolved, by the difference in weight of the apparatus before and after the dissolution of the hydrogen, and also by determining the increase in weight brought about by burning the evolved hydrogen in pure oxygen, affords a means of determining at the same time the atomic weight of aluminium. Corrections must, however, be applied on account of the impurities contained in the aluminium, and the contraction in volume attending the dissolution of the metal. The corrected values for the atomic weight are $Al = 26·770$ $(H = 1)$, or $Al = 26·992$ $(O = 16)$. These numbers do not depend one on the other, but each represents the result of a direct determination by means of which the atomic weight of aluminium is referred to that of the standard element. H. C.

Aluminium Nitride. By LÉON FRANCK (*Chem. Zeit.*, 1897, **21**, 263. Compare Mallet, Trans., 1876, 340; Moissan, Abstr., 1894, ii, 450).—Aluminium nitride is obtained when an intimate mixture of finely divided aluminium and calcium carbide is heated in a porcelain crucible with access of air, by the aid of a blow-pipe. A product obtained in this way was found to contain 15—20 per cent. of nitrogen. It is very slowly decomposed by moist air, somewhat more rapidly by boiling water, and most readily by alkalis, evolving its nitrogen as ammonia. A better yield may be obtained by passing nitrogen over the above mixture, or over a mixture of aluminium and dry calcium hydroxide. It is considered probable that substances so rich in nitrogen may be of use as fertilisers. J. J. S.

Atomic Weight of Cobalt. By THEODORE WILLIAM RICHARDS and GREGORY PAUL BAXTER (*Zeit. anorg. Chem.*, 1898, **16**, 362—376).—The authors have determined the atomic weight of cobalt from the ratio of cobalt bromide to silver bromide and to silver. The methods employed for obtaining the cobalt bromide in a perfectly dry state, and for weighing the same, are similar to those already employed in the case of nickel (Richards and Cushman, this vol., ii, 228). Full details of the preparation of the materials are given in the original paper. The mean of the first series of 3 experiments gave $Co = 58·984$; the mean of the second series of 9 experiments gave $Co = 58·995$; the mean of the third series of 8 experiments gave $Co = 58·987$ (taking $O = 16$. $Ag = 107·93$). The atomic weight of cobalt is therefore 58·99 $(O = 16)$ or 58·55 $(O = 15·88)$. E. C. R.

Tetramminecobalt Sulphite. By KARL A. HOFMANN and S. REINSCH (*Zeit. anorg. Chem.*, 1898, **16**, 377—397).—Cobalt acetate is dissolved in 7 per cent. ammonia, and the solution allowed to remain exposed to the air until it becomes deep violet; it is then saturated with sulphurous anhydride, and the amorphous, brown precipitate separated and washed with sulphurous acid; after drying over sulphuric acid, the precipitate has the composition $Co_2(SO_3)_3(NH_3)_2 + 5H_2O$ or $3H_2O$. It is sparingly soluble in water, and yields cobalt hydroxide when treated with sodium hydroxide. When boiled with 7 per cent. ammonia, it is converted into the compound $Co(NH_3)_4(SO_3)_2NH_4$, which crystallises in brown plates, is sparingly soluble in water, is decomposed by boiling water, and when treated with hydrochloric acid is converted into the tetrammineroseochloride and a small quantity of praseochloride. The sulphite group cannot be detected by the ordinary reactions.

The group SO_3NH_4 in these compounds is easily replaced by the thiocyanogen, cyanogen, and hydroxyl groups. The compound $Co(NH_3)_4(SO_3)CNS + 2H_2O$, obtained by warming the preceding ammonium compound with ammonium thiocyanate, crystallises in brownish-yellow leaflets, turns red when dehydrated at 80° over sulphuric acid, and is decomposed by boiling with water. When treated with fuming hydrochloric acid, it yields the praseochloride, and with concentrated sulphuric acid it yields a brownish-red solution which quickly changes to violet. When shaken with silver oxide and water, it is converted into the compound $[Co(NH_3)_4H_2O]SO_3OH + 2H_2O$, which is a reddish-yellow, crystalline powder sparingly soluble in water. When the thiocyanate derivative is treated with potassium cyanide, it yields the compound $[Co(NH_3)_4H_2O]SO_3CN + H_2O$.

Vortmann and Magdeburg have obtained a compound which is apparently identical with the authors' aquopentamminecobalt sulphite, by dissolving roseocobalt chloride and ammonium hydrogen sulphite in dilute ammonia. It is obtained in lustrous, brownish-yellow leaflets, together with the tetramminecobalt ammonium sulphite, and is much more soluble in dilute ammonia than the latter, which is easily converted into the aquopentammine sulphite by prolonged digestion with an ammoniacal solution of ammonium sulphite.

Aquopentamminecobalt sulphite, $[Co(NH_3)_5H_2O](SO_3)_3 + H_2O$, crystallises in lustrous, monosymmetric plates; it is also obtained, together with the sparingly soluble aquotetramminecobalt ammonium sulphite, by digesting carbonatotetramminecobalt chloride with ammoniacal ammonium sulphite. When treated with fuming hydrochloric acid, it yields a brownish-yellow solution, then a red, crystalline powder (probably tetrammineroseochloride) and a violet solution. With concentrated sulphuric acid, it gives a beautiful, ruby-red solution.

The *compound*, $[Co_2(NH_3)_9H_2O]3SO_3,2H_2O$, is obtained by allowing an ammoniacal solution of cobalt acetate to remain exposed to the air for 2—3 days, and then treating it with sulphurous anhydride, taking care that an alkaline reaction is maintained; the yellowish-brown precipitate is boiled with ammonia, and the filtrate allowed to crystallise. It forms slender, brownish-yellow needles, and is easily soluble in warm water; with fuming hydrochloric acid, it gives an intense red solution, which deposits a crystalline mixture of praseochloride and aquotetrammine chloride; with sulphuric acid, it gives a red solution which quickly changes to bluish-red.

When treated with aqueous ammonium thiocyanate, the last two compounds described above yield the compound $[Co(NH_3)_4H_2O]SO_3CSN + H_2O$, which is identical with the thiocyanate described above. When treated with potassium cyanide, they yield the compound $[Co(NH_3)_4H_2O]SO_3CN + H_2O$; this crystallises in reddish-yellow, rhombic tablets, is decomposed by boiling water, and when treated with fuming hydrochloric acid is converted into the compound $[Co(NH_3)_4H_2O]CN,Cl_2$; when the latter is treated with silver nitrate, the chlorine is completely eliminated, but not the cyanogen.

The compound $[Co_2(NH_3)_9H_2O]3SO_3 + 2H_2O$, when treated with sodium nitrite and ammonium chloride, yields the compound $Co(NH_3)_4SO_3,NO_2$ as a yellow, crystalline powder, which is sparingly soluble in water, and when treated with fuming hydrochloric acid yields praseochloride.

Aquotetramminecobalt ammonium sulphite,

$$[Co(NH_3)_4H_2O]SO_3{\cdot}SO_3NH_4 + 2H_2O,$$

which is obtained from the carbonatotetrammine chloride by digesting it for some days with ammoniacal ammonium sulphite, crystallises in brown prisms; with fuming hydrochloric acid it yields a greenish-yellow solution which gradually becomes green and then blue, and deposits red crystals of the aquotetrammine chloride.

Sulphitotetramminecobalt sodium sulphite, $Co(NH_3)_4SO_3,SO_3Na,2H_2O$, is obtained by digesting Jörgensen's carbonatotetrammine chloride with an ammoniacal solution of sodium hydrogen sulphite; it crystallises in yellowish-brown leaflets, is easily soluble in water, and gives a reddish-violet solution with concentrated sulphuric acid.

When carbonatotetrammine chloride is boiled with ammoniacal sodium sulphite, it yields the compound $[Co(NH_3)_32H_2O]SO_3,SO_3Na,5H_2O$, which crystallises in dark-yellow, rhombic crystals; with fuming hydrochloric acid it yields a brownish-yellow coloration which changes to green, and with concentrated sulphuric acid, a reddish-yellow solution which quickly changes to violet. E. C. R.

Constitution of Inorganic Compounds. By ALFRED WERNER and H. GRÜGER (*Zeit. anorg. Chem.*, 1898, **16**, 398—423).—Sulphitopentammine and sulphitotetrammine salts are obtained by adding more or less of a solution of sodium hydrogen sulphite to a solution prepared by passing air for 7 to 8 hours through a mixture of 20 grams of cobalt carbonate dissolved in dilute hydrochloric acid to which 100 grams of ammonium carbonate, 500 grams of water, and 250 grams of concentrated ammonia have been added.

Sulphitopentamminecobalt sulphite, $[CoSO_3(NH_3)_5]_2SO_3 + 2H_2O$, is obtained by adding 10—12 grams of sodium hydrogen sulphite to 500 c.c. of the above solution. After remaining 2—3 days, crystals of disulphitotetramminecobalt ammonia are deposited, and after another 3 days the crystals of the pentammine salt begin to separate; it crystallises in brown tablets and is easily soluble in warm water. The *chloride*, $[CoSO_3(NH_3)_5]Cl$, is obtained by treating the sulphite with the theoretical quantity of concentrated hydrochloric acid; it is a well crystallised salt, easily soluble in water and is precipitated by hydrochloric acid and alcohol. It is unstable in aqueous solution, but quite stable when dry, and when treated with sodium hydrogen sulphite it yields a crystalline double salt. The *hydrochloride* $[CoSO_3H(NH_3)_5]Cl_2$, is obtained by treating finely powdered sulphitopentamminecobalt chloride with concentrated hydrochloric acid and then washing out the excess of acid with anhydrous alcohol; it is a carmine, crystalline powder which, on exposure to damp air, quickly decomposes into sulphitopentamminecobalt chloride. The *bromide* separates in brownish-red crystals, the *nitrate* in small, brown crystals. The *double salt with sodium sulphite*, $[CoSO_3(NH_3)_5]_2SO_3 + 2Na_2SO_3 + H_2O$, is obtained by treating the chloride with sodium hydrogen sulphite until the colour changes to yellow; on adding a small quantity of alcohol to the solution, it crystallises in bright yellow leaflets, easily soluble in water; it decomposes when exposed to the air.

Disulphitotetramminecobalt ammonia, $[Co(SO_3)_2(NH_3)_4]NH_4 + 3H_2O$, is obtained by adding a larger quantity of sodium hydrogen sulphite to the above oxidised solution; it crystallises in large, dark brown crystals, is easily soluble in warm water, decomposes slowly in solution, and when treated with alkalis yields the corresponding alkali salts with evolution of ammonia; its aqueous solution yields insoluble precipitates with the salts of the alkaline earths, mercury, silver, and gold. It dissolves in concentrated sulphuric acid, with evolution of sulphurous anhydride, and on adding hydrochloric acid to the solution the green praseo-salt is precipitated. The *sodium salt*, $[Co(SO_3)_2(NH_3)_4]Na + 2H_2O$, obtained by saturating the oxidised cobalt solution with solid sodium hydrogen sulphite, crystallises in small, golden-yellow leaflets, and decomposes when allowed to remain in aqueous solution. The *potassium* salt crystallises in dark yellow needles, the *rubidium* salt in bright brown needles. The *lithium double salt with ammonium sulphite*, $2[Co(SO_3)_2(NH_3)_4]Li,(NH_4)_2SO_3$, obtained by treating the ammonium salt with lithium hydroxide in the absence of carbonic anhydride, crystallises in small, brownish-yellow, lustrous leaflets; it is easily soluble in water but quickly decomposes, with the formation of an insoluble brown precipitate. The *cæsium* salt,

$$[Co(SO_3)_2(NH_3)_4]Cs,2(NH_4)_2SO_3,2H_2O,$$

obtained in a similar manner to the lithium salt, crystallises in small, dark brown aggregates, is very soluble in water, and quickly decomposes when kept.

The silver, gold, mercury, barium, cadmium, and copper salts of disulphitotetramminecobalt are also described. E. C. R.

Inorganic Hydroxylamine Compounds. By KARL A. HOFMANN and VOLKMAR KOHLSCHÜTTER (*Zeit. anorg. Chem.*, 1898, **16**, 463—474).—The *compound* $HO·Ca·O·NH_2$ is obtained by digesting finely powdered lime or calcium carbide with a solution of hydroxylamine in methylic alcohol; it is a white powder, is partially decomposed by water at the ordinary temperature into calcium hydroxide and hydroxylamine, and at once reduces Fehling's solution and ammoniacal silver nitrate.

Hydroxylamine ammonium tungstate, $NH_4O·WO_4·NH_4$, is obtained by treating finely powdered sodium paratungstate with an aqueous solution of hydroxylamine hydrochloride, and then dissolving the product in 15 per cent. ammonia; it crystallises in thick tablets when the solution is allowed to evaporate over potassium hydroxide, and at once reduces Fehling's solution and ammoniacal silver nitrate.

The *compound* $NH_4{\cdot}HPO_3{\cdot}NH_4O$, is obtained by neutralising phosphorous acid with ammonia, then adding four times the quantity of ammonia and two molecular proportions of hydroxylamine hydrochloride to 1 of the acid; after remaining one hour, the solution is precipitated with alcohol and the product recrystallised from absolute alcohol. It is also obtained by heating diammonium phosphite, $HPO_3(NH_4)_2$, with hydroxylamine hydrochloride in absolute alcohol and dissolving out the excess of hydroxylamine hydrochloride from the product by warming it with methylic alcohol. It crystallises in slender, white needles, and at once reduces Fehling's solution and ammoniacal silver nitrate.

The *compound* $HPO_3(NH_4O)_2$ is obtained by mixing an aqueous solution of disodium phosphite with 3 molecular proportions of hydroxylamine hydrochloride, and after crystallising out the sodium chloride by evaporation in a vacuum over sulphuric acid, the gummy residue is crystallised from absolute alcohol; it crystallises in long, colourless needles, burns, when heated, with a green flame and evolution of hydrogen phosphide, and quickly reduces Fehling's solution and ammoniacal silver nitrate.

The *compound* $(H_2PO_2)_2(NH_3O)_3K_2$ is obtained by adding hydroxylamine hydrochloride to a solution of hypophosphorous acid made strongly alkaline with potassium hydroxide and mixed with absolute alcohol and a little ether. It crystallises from absolute alcohol in thin plates, melts at 86°, is easily soluble in water, and when heated at 90° in aqueous solution rapidly evolves hydrogen phosphide. When hydroxylamine hypophosphite is treated with a solution of hydroxylamine and sodium methoxide in methylic alcohol, a crystalline compound is obtained which explodes violently.

Metavanadic acid, VO_3H, yields three crystalline products with hydroxylamine namely, $VO_6N_5H_{16}$, $VO_5N_4H_{13}$, and $VO_6N_3H_{10}$. The *compound* $VO_3H(NH_3O)_2(NH_3)_2$ is obtained as follows. Strong ammonia (100 c.c.) is saturated at 5° with ammonia and mixed with finely-powdered hydroxylamine hydrochloride (10 grams); the mixture is cooled to 0° and ammonium metavanadate (3 grams) gradually added and the mixture allowed to remain at 0° until yellow crystals separate; the lemon-yellow leaflets thus obtained are washed with strong ammonia and dried in an atmosphere of ammonia over potassium hydroxide at as low a temperature as possible. It is quickly decomposed by water and dilute sodium hydroxide, dissolves in hydrochloric or sulphuric acid with evolution of nitrous oxide, and when heated decomposes with a slight explosion. The *compound* $VO_6N_5H_{16}$ is obtained in a similar manner to the preceding, but only 1·5 grams of ammonium metavanadate are employed to 10 grams of hydroxylamine hydrochloride; it crystallises in slender yellow needles, is rapidly decomposed by moisture and carbonic anhydride, and contains 1 mol. metavanadic acid, 3 mols. hydroxylamine, and 2 mols. ammonia. The *compound* $VO_6N_3H_{10}$ is very unstable and was not obtained in a pure state.

The *compound* $Nb{\cdot}O_6N_3H_{10}$, obtained by treating potassium pyroniobate, $K_8Nb_6O_{19} + 16H_2O$, with strong ammonia and hydroxylamine

hydrochloride for some days, is a white powder only slightly soluble in water, and explodes violently with a yellowish flame when heated.
E. C. R.

Decomposition of Auric Chloride in Dilute Solution. By Edward Sonstadt (*Chem. News*, 1898, 77, 74).—A solution was prepared containing one part of ordinary auric chloride, dried on the water bath, in 15,000 parts of distilled water that had been coloured with dichromate and redistilled. This solution, on heating for some hours, yielded a precipitate of gold, whilst hydrogen peroxide was detected in the solutions. The change is expressed by the equation $AuCl_3 + 2H_2O = AuCl + 2HCl + H_2O_2$, the aurous chloride yielding gold and auric chloride when heated with water. An analogous behaviour of platinic chloride in dilute solutions has already been noted (Proc., 1898, 25).
D. A. L.

Action of Carbonic Oxide on Palladious Chloride. By Edward Fink (*Compt. rend.*, 1898, 126, 646—648).—When palladious chloride is heated at 260° in a current of carbonic oxide, a crystalline product is obtained which is red near the hot part of the tube and yellow where it has condensed in the cooler parts of the tube. The crude product, when heated, yields a sublimate of colourless needles, whilst a reddish-brown liquid remains and crystallises in yellow needles on cooling. The yellow substance, when purified by crystallisation from carbon tetrachloride, melts at 132°, and has the composition $2PdCl_2,3CO$. It is decomposed by water in accordance with the equation $2PdCl_2 3CO + 2H_2O = CO + 2CO_2 + Pd_2 + 4HCl$. When heated at about 263°, it loses carbonic oxide and yields a crystalline, yellowish red product, from which, by sublimation in carbonic anhydride, yellow needles of the compound $CO{:}PdCl_2$ are obtained.

The white needles have the composition $PdCl_2,2CO$ and melt at 142°; at about 218°, they lose carbonic oxide and yield the compound $2PdCl_2,3CO$.

It will be observed that the palladium compounds are analogous to those formed by platinum.
C. H. B.

Mineralogical Chemistry.

Gaseous Constituents of Certain Mineral Substances and Natural Waters. By William Ramsay and Morris W. Travers (*Proc. Roy. Soc.*, 1897, 60, 442—448).—The authors have examined the gases evolved when several finely-powdered minerals are heated to a red heat, either alone or with potassium hydrogen sulphate. Samples of fergusonite, monazite, samarskite, and columbite gave from 1·3—1·5 c.c. of helium per gram, whilst pitchblende, from Colorado, gave from 0·27—0·3 c.c. per gram; malacone, $ZrSO_4$, from Hitteroe in Norway, contained traces of both argon and helium. Cinnabar and cryolite gave small quantities of carbonic oxide only, whilst from apatite hydrogen also was obtained; from barytes, celestine and scapolite, no gas was evolved. Hydrogen alone was obtained from serpentine, from the Riffelhorn, and from gneiss from Kashmir, whilst a cobalt ore, containing manganese dioxide, yielded oxygen only. Lava from Iceland gave carbonic anhydride only, whilst the blue clay and the coarse-grained gravel of the Kimberley diamond field yielded hydrogen and carbonic oxide. From five specimens of meteoric iron, hydrogen only was obtained, without a trace of either argon or helium.

A carboy of water from the Old Sulphur Well, Harrogate, yielded 45 c.c. of argon, whilst from the same quantity of water from the Strathpeffer Wells 25 c.c. were obtained. Samples of gas from the Raillière, Des Œufs, Cæsar and Espagnol springs at Cauterets, Hautes-Pyrénées, contained both argon and helium. Attempts to separate these gases by diffusion, and by taking advantage of their relative solubilities in water, led to no result. The helium was, however, obtained in a pure state by absorbing it by the platinum electrodes of a vacuum tube (compare this vol., ii, 375), and subsequently liberating the gas by heating the tube.

From their experiments, the authors conclude that no new gaseous element is present in the minerals or natural waters examined.

W. A. D.

Gases enclosed in Crystalline Rocks and Minerals. By William A. Tilden (*Proc. Roy. Soc.*, 1897, 60, 453—457).—A number of rocks and minerals examined by the author gave, on being heated, volumes of gas, varying from that of the mineral taken, to eighteen times this volume; the proportion of hydrogen present varied from 12·49 to 88·42 per cent., and that of carbonic anhydride from 5·50 to 77·72 per cent.; carbonic oxide, nitrogen, and methane were present in smaller proportion, but in no case could helium be detected. The gas is apparently enclosed in microscopic cavities, visible in thin sections of the mineral, but none of it is evolved when the latter is coarsely powdered.

The author accounts for the large proportion of hydrogen and carbonic oxide by assuming that the rock crystallised in an atmosphere rich in carbonic anhydride and steam, and in contact with some easily oxidisable substance, for example carbon, a metal such as iron, or a metallic protoxide. Ferrous oxide, a substance of the latter kind, is oxidised by both steam and carbonic anhydride, at a red heat, to the magnetic oxide, the latter substance remaining completely unaffected under these conditions. W. A. D.

Melting Points of Minerals. By Ralph Cusack (*Proc. Roy. Irish Acad.*, 1897, [iii], 4, 399—413).—An improved form of Joly's meldometer (Abstr., 1892, 414) is described. The method forms a convenient means of identifying minerals, and the readings are accurate to 2° of temperature. Most silicates present a greater or less degree of viscosity, and do not seem to fuse at any very definite temperature; quartz softens at 1406°, and is liquid at 1425°, but only runs freely at 1440°. Small variations in composition do not seem to seriously affect the melting point, as seen, for example, in the pyroxenes and amphiboles. The dimorphous rutile and brookite have the same melting point, whilst for the somewhat allied topaz and kyanite it is very different. The following are the extreme values obtained for samples from different localities.

Actinolite ...	1272—1288°	Almandine	1263—1268°	Adularia ...	1164—1168°	Zincite	1260°
Tremolite ...	1219—1223	Idocrase...	1024—1035	Albite	1172	Cassiterite	1127
Hornblende	1187—1200	Epidote ...	954—976	Microcline	1169	Rutile	1560
Diopside ...	1187—1195	Zoisite ...	995	Labradorite	1223—1235	Brookite ...	1560
Diallage......	1264—1300	Dioptase...	1171	Tourmaline	1012—1102	Uraninite...	1188
Augite	1187—1199	Axinite ...	995	Kyanite ...	1090	Vivianite ...	1114
Spodumene	1173	Meionite	1281	Sphene ...	1127—1142	Apatite......	1221—1227
Enstatite ...	1295	Nepheline	1059—1070	Staurolite	1115	Molybdenite	1185
Wollastonite	1203—1208	Sodalite ...	1127—1133	Andalusite	1209	Galena	727
Olivine	1363—1378	Leucite ...	1298	Cuprite ...	1162	Blende	1049

The melting points of topaz, zircon, corundum and wavellite are higher than that of platinum, and therefore cannot be determined by this method.
L. J. S.

Composition of Nova Scotia Coals and other Minerals. By E. Gilpin, jun. (*Trans. Nova Scotian Inst. Sci.*, 1897, **9**, 246—254).—Analyses are given of several coals, iron pyrites, and iron ores.
L. J. S.

Products of Decomposition of Pyrites in the Paris Basin. By Alfred Lacroix (*Bull. Soc. fran. Min.*, 1897, **20**, 288—308).—In the Paris basin, pyrites and marcasite occur in chalk, Eocene clays, lignite, &c. Two main types of alteration may be distinguished as the "hepatic" and the "saline." In the former, the product, limonite or hæmatite, preserves the original form of the mineral. In the latter, the pyrites is more rapidly oxidised in the presence of air to melanterite, $FeSO_4,7H_2O$, and sulphuric acid. By the action of these on the various rocks, secondary products are formed. Sulphuric acid acting on limestone and clay gives gypsum and websterite, $Al_2O_3,SO_3,9H_2O$, respectively. Melanterite and sulphuric acid, in acting on limestone, give gypsum and chalybite, and on clay, halotrichite, $FeSO_4,Al_2(SO_4)_3 + 24H_2O$. By the oxidation of the melanterite, copiapite, $2Fe_2O_3,5SO_3 + 18H_2O$, is formed, and this by its action on limestone gives apatelite, $4Fe_2O_3,6SO_3,3H_2O$, and gypsum. Similar reactions take place in the island of Naxos and at Sasaki in the Gulf of Corinth (Abstr., 1897, ii, 508).
L. J. S.

Berthierite from Bohemia. By Adolf Hofmann (*Sitz.-ber. k. böhm. Ges. d. Wiss.*, 1898, *Jahrg.* 1897, **2**, No. xlix, 3 pp.).—The mineral veins at Bohutin, near Przibram, when in diabase, contain calcite and argentiferous galena, and when in the grauwacke they contain quartz, pyrargyrite and native silver, but those in connection with the more rarely occurring quartz-mica-diorite contain much stibnite. In the last of these berthierite occurs, and the succession of minerals is: chalybite, galena, quartz, stibnite, berthierite, quartz, barytes, galena. The berthierite occurs as fine needles intergrown with quartz and stibnite; from the latter it is easily distinguished by its reddish tarnish. The fractured surfaces are dark steel-grey. Analyses by R. Vambera gave I and II.

	Sb.	Fe.	S.	Pb.	Quartz.	Total.	Sp. gr.
I.	45·60	10·62	23·16	trace	19·76	99·14	3·89—3·91.
II.	42·49	11·04	23·16	trace	23·31	100·00	
III.	56·42	13·89	29·69	—	—	100·00	

After deducting quartz, which is seen as microscopic enclosures, the mean (III) of these agrees closely with the formula FeS,Sb_2S_3.

L. J. S.

Kalgoorlite, a new Telluride from Western Australia. By Edward F. Pittman (*Records Geol. Survey N.S.W.*, 1898, **5**, 203—204. Compare Abstr., 1897, ii, 503).—The tellurides of Kalgoorlie occur as veins, splashes, and pockets, in dykes of a schistose quartz-felspar-porphyry. A massive, iron-black mineral with sub-conchoidal fracture gave analysis I, by J. C. H. Mingaye, formula, $HgAu_2Ag_6Te_6$; to this the name kalgoorlite is given. The amalgam found in the district may have been produced by the decomposition of this mineral.

	Au.	Ag.	Hg.	Cu.	S.	Te.	Total.	Sp. gr.
I.	20·72	30·98	10·86	0·05	0·13	[37·26]	100·00	8·791.
II.	41·76	0·80	—	—	—	56·65	99·21	9·377.

A pale yellow mineral, also from Kalgoorlie, is shown by analysis II to be probably calaverite.

L. J. S.

Tellurium in Gold-ores from South Dakota. By Frank Clemes Smith (*Trans. Amer. Inst. Mining Eng.*, 1897, **26**, 485—515).—The so-called refractory gold-ores of the Potsdam sandstone in the Black Hills, South Dakota, have been found in all cases to contain tellurium. The blue unoxidised sandstone ore contains pyrites, gypsum, and fluorite; the oxidised ore is red. The average of several assays, which show a few ounces to the ton, gives I as the composition of the telluride. An assay of the richer telluride ore from Cripple Creek, Colorado, gave II. Both these agree in composition with sylvanite.

	Au.	Ag.	Te.	Total.
I.	7·64	32·39	59·96	100·00
II.	5·61	34·23	60·16	100·00

The methods of assaying these ores are described in detail, and their metallurgical treatment discussed.

L. J. S.

[Bismuth Telluride, Apatite and Minervite from N. S. Wales.] By John C. H. Mingaye (*Ann. Rept. for* 1896, *Dept. Mines, N.S.W.*, 1897, 20—21) and by George W. Card (*Records Geol. Survey N.S.W.*, 1897, **5**, 66).—In the report, various technical analyses of rocks, clays, waters, coals, ores, &c., are given, together with analyses of the following minerals, short descriptions of which are given in the second paper.

Bismuth telluride from Slippery Creek, near Oberon. This occurs with free gold in quartz, and is associated with the greenish-yellow alteration product, montanite. A partial analysis gave

Bi.	Te.	S.	Gangue.	Se, Au, Ag.
70·82	19·59	4·69	0·06	Nil.

Apatite from Gordon Brook. Pinkish-white, hexagonal crystals occurring with actinolite in veins traversing granite. The mean of two analyses is

CaO.	P_2O_5	Ca. (?)	Cl.	F.	MgO.	Fe_2O_3.	Gangue.	H_2O.	Total.
48·68	41·16	3·82	1·30	2·89	0·20	0·74	1·28	0·29	100·36

The gangue contained SiO_2, Al_2O_3, Fe_2O_3, CaO, MgO, and traces of P_2O_5.

A white, earthy mineral from the Jenolân Caves has much the same composition as minervite (Abstr. 1893, ii, 419, 577; 1896, ii, 529). The mean of two analyses is

Al_2O_3.	K_2O.	Fe_2O_3.	P_2O_5.	Insol.	H_2O at 200°.	H_2O above 200°.	Total.
20·59	8·95	0·19	40·85	1·09	9·58	18·21	99·46

Also traces of CaO and MgO, but no F, Cl, or SO_3. The associated clay contains some phosphoric acid. L. J. S.

Solution of Silica under Atmospheric Conditions. By C. Willard Hayes (*Bull. Geol. Soc. Amer.*, 1897, **8**, 212—220).—Several cases are cited in which quartz pebbles in conglomerates are etched down to the general level of the exposed rock surface. The dissolution of the quartz is attributed to the combined action of azo-humic acids and alkali carbonate solutions. Thenard (*Compt. rend.*, 1870, **70**, 1412) has shown that simple humic acid dissolves only 8 per cent. of silica, whilst azo-humic acid combines with 7 to 24 per cent., depending on the content of nitrogen; the compounds thus formed are easily soluble in alkali carbonates, forming alkali salts of the silico-azo-humic acids. L. J. S.

"Fresh-water Chalk" from Essex. By Thomas S. Dymond and Frank W. Maryon (*Essex Naturalist*, 1897, **10**, 213—215).—A soft, white, granular substance forms a bed either in or upon glacial drift at Halstead. Analysis of material dried at 100° gave

CaO.	MgO.	Fe_2O_3,Al_2O_3.	P_2O_5.	CO_2.	SiO_2	H_2O and organic matter.	Total.
54·250	Nil	0·563	0·127	42·625	1·200	1·530	100·295

Since remains of organisms were not detected, the material has probably been directly deposited from water owing to loss of carbonic anhydride. L. J. S.

Barytes Nodules in Wood. By Ellsworth B. Knerr (*Trans. Kansas Acad. Sci.*, 1898, **15**, 80—81).—In digging a well near Midland College, bits of wood were met with at a depth of 40 feet. In this wood are numerous white spheres $\frac{1}{32}$—$\frac{1}{8}$ inch diam., with an internal radiated structure. Analysis proved the material to be barytes.

SO_3.	BaO.	CaO.	SiO_2 and gangue.	Total.	sp. gr.
33·25	62·17	0·50	4·00	99·92	4·55

L. J. S.

Aluminite from the Salt Range. By H. H. Hayden (*Records Geol. Survey India*, 1897, **30**, 110)—Aluminite, which has not before been known from India, occurs as veins in the shale underlying the coal seam at Chittidand, in the Salt Range. It has a chalky appearance, and under the microscope is seen to consist of small, monosymmetric crystals. $H = 1—2$; sp. gr. (of impure material) = 1·707· Selected material gave, on analysis,

Al_2O_3.	SO_3.	H_2O.	CaO, ZnO, Fe_2O_3.	Total.
30·08	23·63	46·44	traces	100·15

This agrees with the usual formula, $Al_2O_3,SO_3,9H_2O$. L. J. S.

Deposit in Delaval Colliery, Northumberland. By Charles J. Murton and Saville Shaw (*Trans. Fed. Inst. Min. Eng.*, 1895, 10, 67—71; and *Trans. N. Engl. Inst. M. E.*, 1895, 45, 67).—On a floor of under-clay in some very old workings in the Delaval Colliery, Benwell, Northumberland, a deposit of a soft, white material is found. When exposed to the air, this dries and shrinks to a white, opaque, friable mass, which breaks with a conchoidal fracture, and adheres strongly to the tongue. It is infusible, and is readily soluble in warm, dilute hydrochloric acid. Analysis gave

Al_2O_3.	CaO.	SiO_2.	SO_3.	H_2O.	Total.
37·93	1·90	12·12	5·30	42·44	99·69

Water extracts all the calcium, together with a little silica.

The substance is considered to be a mixture of collyrite, aluminite, and a hydrate silicate of calcium, in the proportions $7(2Al_2O_3,SiO_2,9H_2O) + Al_2(SO_4)_3,2Al_2O_3,9H_2O + 2(CaO,SiO_2,18H_2O)$.

[Aluminite is $Al_2O_3,SO_3,9H_2O$.] L. J. S.

[Nitratine] from South-west Africa. By Hermann Thoms and G. Boelling (*Chem. Centr.*, 1897, ii, 57, 1113; from *Ber. Deutsch. pharm. Ges.*, 1897, 7, 168—170. Compare Abstr., 1896, ii, 529).—A mineral, locally known as "Klipzweet" or "Boomester," occurs as an efflorescence on the undersides of overhanging rocks in the Kharas Mountains and on the Orange River, in Namaqualand, German S.W. Africa. Analysis gave

K_2O.	Na_2O.	CaO.	Fe_2O_3.	N_2O_5.	Cl.	H_2O.	SiO_2.	SO_3.
10·39	27·86	1·10	0·46	38·56	10·54	2·74	7·12	2·88

It is, therefore, an impure nitratine, containing 60·71 per cent. of sodium nitrate. L. J. S

Mossite, and the Crystalline Form of Skogbölite. By Waldemar C. Brögger (*Vidensk. Skrifter, I. Math.-nat. Klasse, Kristiania*, 1897, No. 7, pp. 1—19).—The new mineral, mossite, occurs with yttrotantalite and columbite in a pegmatite vein at Berg in the parish of Råde, near Moss, in Norway. The tetragonal crystals are black with sub-metallic lustre; $a : c = 1 : 0·64379$; they are usually twinned on (101) and elongated in the direction of the pyramid edge $[111, 1\bar{1}1]$, then having the appearance of simple orthorhombic crystals of prismatic habit. Analysis by G. Thesen gave

Nb_2O_5.	Ta_2O_5.	SnO_2.	FeO.	Al_2O_3, MnO, &c.	Total.	Sp. gr.
31	52	0·18	16·62	Nil	99·72	6·45
$\underbrace{\qquad\qquad}_{82·92}$						

This gives the formula $FeNb_2O_6,FeTa_2O_6$. Mossite and tapiolite are therefore to be considered as the tetragonal equivalents of columbite and tantalite respectively. Crystals of tapiolite from Sukula, in Finland, present the same habit and twinning as mossite; $a:c = 1:0·65251$.

The so-called tantalite from Tammela, in Finland (= "Tammela-tantalite" = skogbölite), is shown to be identical with tapiolite. The crystals of this iron tantalate ($FeTa_2O_6$), which were described as orthorhombic with a form more or less closely related to that of columbite, are shown to be really tetragonal and twinned like mossite; $a:c = 1:0·65189$.

The following substances form a homœomorphous group: mossite, tapiolite, dechenite ?, $AgClO_3$, $AgBrO_3$, xenotime, acid phosphates and arsenates of ammonium and potassium, rutile, cassiterite, &c.; and there is a double homœomorphism shown by rutile and brookite with mossite and columbite. L. J. S.

Synthesis of Perofskite and Pyrochlore Minerals. By Per Johan Holmquist (*Bull. Geol. Inst. Upsala*, 1897, 3, 181—262).—A detailed summary is given of the literature of perofskite and pyrochlore, and of the minerals related to them, namely, dysanalyte, knopite, koppite, hatchettolite, microlite, pyrrhite and azor-pyrrhite. The various methods which have been successful in the artificial production of any of these minerals, or of related compounds, are also reviewed.

By fusing the pure oxides with sodium fluoride at a high temperature (1500°), and slowly or quickly cooling, the author has obtained the following crystallised compounds.

Tantalic acid and niobic acid. The flux here used was borax. The crystals are probably orthorhombic. Sp. gr. of the former = 7·777, and of the latter = 4·568. Na_2O,Nb_2O_5, by fusing sodium carbonate and niobic acid with sodium fluoride; pseudo-cubic crystals with optical anomalies; sp. gr. = 4·512—4·559. $2Na_2O,Nb_2O_5$, by the same method, but with the materials in different proportions; this is decomposed by water.

$Na_2O,3TiO_2$; orthorhombic needles; sp. gr. = 3·4925—3·508. This is considered to be possibly isomorphous with perofskite, CaO,TiO_2, since a powder having this composition is absorbed by the needles to the extent of 32·9 per cent. Perofskite is not formed by fusing the oxides with sodium fluoride. When molten sodium and calcium carbonates are poured into fused $TiO_2 + Na_2CO_3$, there is a precipitation of pseudo-cubic perofskite crystals, which show the same optical anomalies as the natural mineral.

$2CaO,Nb_2O_5$; acicular and pseudo-cubic crystals; sp. gr. = 4·484. $3CaO,Nb_2O_5$ with part of the calcium replaced by sodium; pseudo-cubic. $2CaO,Ta_2O_5$; pseudo-cubic. Most of the above calcium salts are pseudo-cubic, some are also orthorhombic, and probably represent dimorphous forms. $5ThO_2,16Nb_2O_5$ and $ZrO_2,5Nb_2O_5$ (Abstr., 1896, ii, 564) are also described.

Pyrochlore and dysanalyte; colourless isotropic octahedra with the composition $NaCaNb_2O_6F$; sp. gr. = 4·196—4·290; index of refraction for sodium light, 2·149. When this was heated to a higher temperature and slowly cooled, octahedral and pseudo-cubic crystals were formed; the latter had a sp. gr. = 4·122—4·399, and composition $3(Na_2O,Nb_2O_5),2(2CaO,Nb_2O_5)$, thus corresponding with a sodium-calcium-dysanalyte. Under the same conditions, but with the presence of some iron and manganese, yellow, isotropic octahedra of pyrochlore and black, shining cubes of dysanalyte were produced; these differ somewhat in composition from the preceding, and there seems to be isomorphous replacement between them. In the presence of cerium, brown octahedra of koppite were obtained, together with dysanalyte. A uranium pyrochlore (hatchettolite) was prepared as isotropic octahedra; this has the composition $7(Na_2O,Nb_2O_5) + 2(2UO_2,Nb_2O_5)$. From the analysis of these products, resembling pyrochlore and dysanalyte, complicated formulæ are given. Twinned tetragonal crystals related to microlite were also prepared.

The chemical constitution, and the nature of the optical anomalies of these salts and minerals, is discussed in detail; between the pseudo-cubic and the orthorhombic members, a crystallographic relation can be traced.

The composition of natural pyrochlore is discussed, and the following new analysis given of the Alnö mineral; sp. gr. = 4·348 (compare Abstr., 1895, ii, 509).

Nb_2O_5.	TiO_2.	ZrO_2.	Ce_2O_3.	FeO.	CaO.	Na_2O.	K_2O.	F.	H_2O.	Total (less O for F).
65·29	2·85	2·58	5·03	1·10	16·20	6·29	0·37	4·08	0·44	102·51

For this the formula is given as $5(NaCaNb_2O_6F) + 2(NaCa_2Nb_2O_7F) + CaTiO_3 + 2CaO,Nb_2O_5$. L. J. S.

Chloritoid from Kincardineshire. By George Barrow (*Quart. Journ. Geol. Soc.*, 1898, **54**, 149—156).—Minute, dark, glistening crystals of chloritoid occur in a spotted schist at Drumtochty, near Fordun, and at other localities in Kincardineshire; they are hard and brittle, have a rudely hexagonal outline, and are dark green by transmitted light. Under the microscope, they are seen to have jagged edges, and to be intergrown with, and enclose, quartz, chlorite, and mica. Twinning is frequent, and there is a fairly well-marked basal cleavage. The pleochroism is strong, the colour varying from green to indigo-blue; optically positive, with high index of refraction and low birefringence. The collection of pure material was a matter of some difficulty; four analyses showed a decrease in silica and alkalis, as the material was increased in purity; the most pure gave,

SiO_2.	Al_2O_3.	Fe_2O_3.	FeO.	MgO.	Mn.	Alkalis.	Loss on ignition.	Total.
26·00	40·05	5·05	19·50	2·88	trace	trace	6·00	99·48

In composition, the mineral agrees closely with the chloritoid, from the Ile de Groix, examined by Barrois. It is suggested that chloritoid and ottrelite, both of which have the same optical characters, may be identical, and that the differences shown in the analyses are due to impurities enclosed in the crystals. L. J. S.

Manganiferous Conglomerate from Essex. By THOMAS S. DYMOND (*Essex Naturalist*, 1897, 10, 210—212).—Hard, tabular masses of cemented gravel occur on the surface of the London clay in the neighbourhood of Tendring, near Colchester; they are used as building stones. Analysis of the cementing material gave,

SiO$_2$ and sand.	MnO$_2$.	MnO.	Fe$_2$O$_3$.	H$_2$O (at 120°)	Ca, Al, &c.	Total.
60·960	6·505	2·840	18·315	7·850	[3·530]	100·000

L. J. S.

Weathering of Micaceous Gneiss in Virginia. By GEORGE P. MERRILL (*Bull. Geol. Soc. Amer.*, 1897, 8, 157—168. Compare Abstr., 1896, ii, 483; 1897, ii, 107).—A highly felspathic gneiss with abundant black mica occurs at North Garden, in Albemarle Co., Virginia; it contains orthoclase, soda-lime felspars, and quartz, with accessory zircon, iron ores, and apatite, and, in considerable quantity, radiating masses of a soda-potash zeolite. Analysis of the fresh rock gave the results under I; the portion soluble in hydrochloric acid and sodium carbonate solutions gave II. In weathering, the rock becomes brownish and friable, and finally passes into red sand and clay. The decomposed rock gave analysis III; the portion soluble in hydrochloric acid and sodium carbonate solutions, IV; and the insoluble portion, V; this being mainly quartz.

	SiO$_2$									Loss on ignition.	
	in HCl.	in Na$_2$CO$_3$.	Al$_2$O$_3$.	Fe$_2$O$_3$.	CaO.	MgO.	K$_2$O.	Na$_2$O.	P$_2$O$_5$.		Total.
I.	60·69		16·89	9·66	4·44	1·06	4·25	2·82	0·25	0·62	100·08.
II.	1·43	8·66	13·54		1·64	0·89	2·40	1·10	0·23	0·62	30·51.
III.	45·31		26·55	12·18	trace	0·40	1·10	0·22	0·47	13·75	99·98.
IV.	0·55	17·14	24·86	11·80	0·06	0·37	0·75	0·25	—	13·40	69·18.
V.	28·90		1·55	0·22	0·07	0·04	0·31	trace	trace	0·35	31·44.

The loss and gain of the various constituents are calculated on the assumption that the alumina has remained constant (Abstr., 1897, ii, 107); this shows that 44·67 per cent. of the original matter has been leached away, that of the original silica 52·45 per cent. is lost, and that most of the iron remains, whilst most of the lime, magnesia, and alkalis are carried away.

The mode of formation of zeolites in rocks is discussed; they seem to be the results of deep-seated hydrometamorphism, rather than of surface weathering. The occurrence of zeolites in soils is doubted, and the soluble potash, &c., is attributed to the presence of pinite.

L. J. S.

Granite from Königshain. By J. HAZARD (*Chem. Centr.*, 1897, ii, 675; from *Geol. Spezialkarte K. Sachsen, Sektion Löbau-Reichenbach*).—The granite boss of Königshain consists of a medium to coarse grained rock, composed of quartz and felspar with a little mica. The felspars, analysed by A. Becker, are: I, microcline-albite-perthite; II, albite. Albite from the pegmatite gave III.

	SiO$_2$.	Al$_2$O$_3$.	Fe$_2$O$_3$.	CaO.	MgO.	K$_2$O.	Na$_2$O.	Loss on ignition.	Total.
I.	64·52	22·48	0·60	0·96	0·60	1·68	9·40	0·36	100·60.
II.	64·06	18·83	0·52	—	—	12·88	3·07	0·50	99·86.
III.	67·77	19·85	—	—	—	—	12·32	0·12	100·06.

In drusy cavities in the granite are: æschynite, albite, anatase, aphrosiderite, axinite, beryl, cassiterite, chlorite, diaspore, epidote, fergusonite, fluorite, gadolinite, hæmatite, magnetite, meroxene, microcline, microcline-albite-perthite, molybdenite, orangite, psilomelane, smoky quartz, tourmaline, wolframite, xenotime, zinnwaldite, zircon, and malacone. The surrounding granites and diorite dykes are altered at the contacts of this granite boss. L. J. S.

Phosphatised Trachyte from Clipperton Atoll. By J. J. Harris Teall (*Quart. Journ. Geol. Soc.*, 1898, **54**, 230—232).—On one part of the ring of Clipperton Atoll, in the northern Pacific, is a mass, 60 feet high, of more or less altered trachyte. The least altered rock is brown, and consists of phenocrysts of sanidine set in a groundmass of microlitic felspars and brown interstitial matter; analysis gave the results under I; the phosphoric acid is present in the brown substance. More altered, white or cream-coloured, material gave II and III.

	SiO_2.	P_2O_5.	Al_2O_3.	Fe_2O_3.	CaO.	K_2O.	Na_2O.	Loss on ignition.	Total.
I.	54·0	8·4	17·9	4·4	1·4	4·5	5·0	3·8	99·4.
II.	43·7	17·0	—	—	—	—	—	12·2	—
III.	2·8	38·5	25·9	7·4	(Insoluble 2·2)			23·0	99·8.

These analyses show that the gradual removal of the silica and alkalis is accompanied by the introduction of phosphoric acid and water; the change has probably been effected by a solution of ammonium phosphate derived from guano (compare Abstr., 1896, ii, 185). Examination of microscopic sections shows that the phosphatising process first attacks the interstitial matter, then the microlitic felspars, and last of all the porphyritic sanidines. Under a high power, the secondary substance shows a concretionary or agate-like structure. The composition shown in analysis III is similar to that of Shepard's redondite, from Redonda in the West Indies; specimens from this place show the structure of an andesite. L. J. S.

Meteoric Irons. By Emil W. Cohen (*Ann. k.k. naturhist. Hofmuseums, Wien*, 1897, **12**, 119—126).—*Nedagolla*, Vizagapatam district, Madras. This is one of the few siderites, and the only ataxite, of which the fall has been observed; it fell on January 23rd, 1870. The structure is granular, like that of the Locust Grove and Forsyth Co. irons (Abstr., 1897, ii, 272, 416). Analysis gave the results under I.

Primitiva, Tarapaca, Chili.—This iron has also the granular structure of an ataxite; schreibersite and graphite are present. Analysis of material freed as far as possible from schreibersite gave II. Chromium and chlorine are absent.

Newstead, Roxburgshire, Scotland.—This iron was found in 1827 at a depth of 3 or 4 feet in a stratum of clay; its meteoric origin has been doubted, and the present author comes to the conclusion that it is artificial. The iron is very brittle, and the microscopic structure resembles that of steel; it also differs from meteoric iron in the high percentage of carbon, and in the absence of nickel and cobalt (analysis

III). Thomson's analysis of 1862 is quoted under IV. Analyses I—III by O. Sjöström.

	Fe.	Ni.	Co.	Cu.	P.	S.	C.	SiO_2.	Total.	Sp. gr.
I.	92·61	6·20	0·49	trace	0·02	0·05	—	0·25	99·62	7·8613
II.	94·72	4·72	0·71	trace	0·18	0·02	0·03	—	100·38	—
III.	96·01	nil.	nil.	—	0·22	0·15	2·96	0·82	100·16	7·0691
IV.	93·51	4·86	—	—	—	—	0·59	0·91	99·87	—

L. J. S.

Water of the Lower Amazon. By Friedrich Katzer (*Sitz.-ber. k. böhm. Ges. Wiss.*, 1898, *Jahrg.* 1897, 1, No. XVII, pp. 1—38).—Several analyses are given of water taken from the Amazon at various points between Obidos and the mouth. The water contains an unusually small amount of soluble constituents, and in this respect the Amazon is one of the purest rivers in the world. L. J. S.

Kansas Mineral Waters. By Herbert E. Davies (*Trans. Kansas Acad. Sci.*, 1898, **15**, 82—88); and by Ellsworth B. Knerr (*ibid.*, 88—89).—In these papers, several analyses are given of mineral waters from Kansas. L. J. S.

Iodine Spring at Wels. By Eugen Ludwig (*Chem. Centr.*, 1897, i, 718; from *Wien klin. Woch*, 1897, **10**, 56—57).—Mineral water issues, at the rate of 48 hectolitres in 24 hours, from a boring 500 m. deep at Wels, in Upper Austria. The Miocene strata, through which the upper part of the boring passes, yield an inflammable gas. The water is ferruginous and becomes cloudy in contact with the air. Temperature 12°, sp. gr. = 1·01219. In 10,000 parts are: KCl, 0·864; $NaCl$, 149·269; Na_3BO_3, 0·322; $LiCl$, 0·153; $BaCl_2$, 0·005; $SrCl_2$, 0·027; $CaCl_2$, 5·95; $Ca_3(PO_4)_2$, 0·014; $MgCl_2$, 1·304; $MgBr_2$, 1·132; MgI_2, 0·386; $MgCO_3,CO_2$, 5·044; $FeCO_3,CO_2$, 1·259; Al_2O_3, 0·004; Mn, trace; SiO_2, 0·226; organic C, 0·814; free CO_2, 0·756.

The amounts of iodine, bromine and chlorine are compared with those in several other springs; that of Zablacz contains the most.

L. J. S.

Physiological Chemistry.

'Survival Respiration' of Muscle. By W. M. Fletcher (*J. Physiol.*, 1898, **23**, 10—99).—The experiments were performed on frogs' muscles, and relate principally to the discharge of carbonic anhydride from these after their removal from the body. The normal course of this discharge and its modifications under various conditions, rigor, putrefaction, and action of acids and other poisons are represented in diagrams. A large series of rapidly performed estimations of carbonic anhydride was made possible by a modification of Blackman's apparatus. The first stage, extending over 5 hours, is one of irregular decline; part of the carbonic anhydride is due to destructive changes in the muscle, part to diffusion from the muscle substance, and part to oxidation changes similar to those obtaining during life. The second stage, described as the 'plateau,' is many hours longer, and shows a very slowly declining rate of discharge; this is the stage which accompanies *rigor mortis*; it passes by gradual degrees into the third stage, in which only traces of the gas are yielded by the muscle. If putrefaction sets in, its occurrence can always be detected by a great increase in the formation of carbonic anhydride. W. D. H.

Chemistry of Contents of Alimentary Tract. By A. LOCKHART GILLESPIE (*Proc. Roy. Soc.*, 1897, 62, 4—11).—The contents of the alimentary canal in dog, calf, and probably in man, are acid throughout. When the food leaves the stomach, it rapidly becomes more concentrated from absorption of water, and consequently more acid; it still contains hydrochloric acid combined with proteid, but the increased proportion of inorganic chlorides indicates that this acid is being rapidly acted on by the soda of the pancreatic fluid. The organisms present fall into two groups, those which produce acid and those which produce alkaline substances; the former do not, as a rule, liquefy gelatin; the latter are the ordinary putrefactive organisms. The former are generally in excess; the ammonia formed by the second group unites with the lactic acid formed by the first, and the salt so formed is advantageous for the further development of both kinds. Excess of hydrochloric acid leaving the stomach causes a relatively great destruction of the alkali-forming organisms, and thus lessens decomposition in the intestine.

Salol is an antiseptic which exerts its power chiefly in the lower part of the intestine, and on the acid-forming organisms; calomel acts principally on the alkali-producing organisms, and in the upper region of the bowel.

Trypsin, although it is slowly destroyed by organic acids, is yet capable of considerable proteolytic action in their presence.

The absorption of fluids is greatest in the duodenum and lower ileum. W. D. H.

Spontaneous Emulsifying of Fatty Oils. By W. LOEWENTHAL (*Chem. Centr.*, 1897, ii, 619; from *Du Bois-Reymond's Arch.*, 1897, 258—269).—Gad (*Du Bois-Reymond's Arch.*, 1878, 181) observed that rancid oil forms an emulsion with dilute sodium carbonate solution even when the mixture is not shaken. The author finds that a 0·06 to 0·18 per cent. solution of sodium carbonate free from sodium chloride forms an emulsion most readily; with a 0·15 per cent. solution of carbonate, 6 per cent. of oleic acid must be present in the olive oil, and when 1 per cent. of sodium chloride is contained in a 0·06 per cent. solution of carbonate 2·3 per cent. of oleic acid is sufficient. The emulsifying power of the carbonate solution containing chloride is increased by adding soap solution. A content of chloride of more than 6 per cent. interferes with the action, but this effect can be compensated by adding bile; when, however, chloride is absent, or the content of acid is lower, the addition of bile hinders the formation of an emulsion. For olive or rape oil, the best conditions are attained when 9 per cent. of oleic acid in a solution of 0·06 per cent. of sodium carbonate is present; castor oil does not emulsify. E. W. W.

The Relationship of Nutrition-need to the Nitrogenous Constituents of the Body. By BERNHARD SCHÖNDORFF (*Pflüger's Archiv.*, 1898, **71**, 420—426).—Pflüger found that in dogs, 1 kilo. of the body flesh demands a minimum of 2·073 grams of nitrogen in the meat given as food. On repeating these experiments, the number found (2·099) is nearly identical with Pflüger's. There are, however, circumstances in which there may be variations, but what all these circumstances are demands renewed investigation; certainly under the influence of thyroid-feeding the number is greater (2·657).

W. D. H.

Absorption and Excretion of Iron in the Human and Animal Body. By A. HOFMANN (Zurich) (*Virchow's Archiv.*, 1898, **151**, 488—512).—Microchemical investigation of the wall of the alimentary canal shows that in man the principal absorption is in the duodenum. The appearances are little different when medicinal doses of iron are added to the food; the liver, and especially the spleen, are the places where iron is stored, whilst it is excreted by the kidney and large intestine. Analogous results were found in the guinea pig. It is believed that inorganic salts of iron are capable of absorption. W. D. H.

Comparative Chemistry of the Suprarenal Capsules. By B. MOORE and SWALE VINCENT (*Proc. Roy. Soc.*, 1898, **62**, 280—283).—The paired suprarenal bodies of elasmobranch fishes correspond structurally and functionally with the medulla of mammalian suprarenals. The inter-renal body corresponds to the cortex. The suprarenal of Teleostean fishes consists solely of cortex.

The chromogen obtainable from the elasmobranch paired bodies is of the same chemical nature as that found in the mammalian medulla.

W. D. H.

Phosphorus in Organic Tissues. By LÉOPOLD JOLLY (*Compt. rend.*, 1898, **126**, 531—533).—Experiments have been made in order to determine whether animal and vegetable tissues contain unoxidised phosphorus in addition to metallic phosphates; the results were all negative. Among the substances examined were vegetables, and sheep's brains and flesh.

It has been found that sheep's brains contain about twice as much phosphoric acid as the muscular tissue. J. J. S.

Influence of Acids and Alkalis on the Electrotonic Currents of Medullated Nerve. By AUGUSTUS D. WALLER (*Proc. Roy. Soc.*, 1897, **62**, 80—99).—A full account of experiments previously published (compare Abstr., 1897, ii, 220). W. D. H.

Composition of Human and Cows' Milk. By WILLIAM CAMERER and FRIEDRICH SÖLDNER (*Zeit. Biol.*, 1898, **36**, 277—313. Compare Abstr., 1896, ii, 378; 1897, ii, 112).—In human milk, the material regarded by Pfeiffer as proteid contains 40 per cent. of some unknown nitrogenous substance. In 100 grams of human milk, 11 milligrams of nitrogen are contained in decomposition products like urea and ammonia; of the remaining nitrogen, 88 per cent. belongs to proteids, and 12 per cent. to unknown, probably diffusible, materials.

In cows' milk, the corresponding amounts are 18 milligrams, 98 per cent. and 2 per cent. The unknown materials of human milk are either much poorer in nitrogen than proteid, or consist of a mixture of nitrogenous and non-nitrogenous substances.

Experiments on inversion by means of dilute hydrochloric acid, with both varieties of milk, show that the carbohydrate there present, which reduces Fehling's or bismuth solution, is not increased. Pentoses were not found. W. D. H.

Metabolism in Leucæmia and Pseudoleucæmia. By WACLAW VON MORACZEWSKI (*Virchow's Archiv.*, 1898, **151**, 22—52).—Complete tables are given of the analyses of food and excretions in a case of leucæmia and in one of pseudoleucæmia; the observations extended over a prolonged period. As a result, leucæmia is characterised as a nitrogen and phosphorus disease; pseudoleucæmia as a nitrogen disease. As in other forms of anæmia, they may be also regarded as chlorine and calcium diseases, that is to say, there is a retention in the body of the substances mentioned; the katabolic side of metabolism is in abeyance, and this is possibly connected with diminution of oxidation processes. Treatment with spleen tabloids had practically no effect; with oxygen, the excretion of phosphorus and calcium is increased; with thyroid tabloids, the metabolism becomes almost normal. W. D. H.

Physiological Action of Hydroxylamine Hydrochloride. By W. B. BRODIE (*Proc. Roy. Soc. Edin.*, **22**, 56).—Solutions of 1 per cent. strength were employed after neutralisation with acid; it appears to act as a poison to protoplasmic structures, but its mode of action is not explained; it may be dependent on some reducing action.

When the neutralised solution or a crystal of the salt which is acid is added to blood-pigment, the two dark bands of oxyhæmoglobin gradually fade and broaden out, but never absolutely disappear, whilst the part of the spectrum, from the commencement of the green to the violet, is darkened; it resembles the spectrum of alkaline hæmatin, with the addition of these two faint bands. The single band of reduced hæmoglobin is never seen. E. W. P.

Formation of Fat during Phosphorus Poisoning. By EDUARD PFLÜGER (*Pflüger's Archiv.*, 1898, **71**, 318—332).—Polimanti (this vol., ii, 307) has recently stated that in frogs, phosphorus poisoning leads to an increased formation of fat in the body. This fat is considered to originate from proteid, as the frogs employed were winter frogs in which the amount of glycogen in the body is reduced to a minimum. On this last point, Polimanti himself made no experiments, but took for granted the statements of Schiff and Luchsinger. The possibility of the origin of fat from proteid has always been strenuously resisted by Pflüger, who in the present paper subjects Polimanti's work to vigorous criticism.

He shows that frogs at the end of their winter sleep do contain a remarkably high (nearly 1·0) percentage of glycogen; he calculates that this would be more than sufficient to explain the increase of fat found in Polimanti's experiments. He, moreover, points out that

Polimanti's calculations require correction, that sufficient care was not exercised in the selection of frogs of a uniform size, and that the method of extraction of the fat was faulty. This last point is more fully discussed in a paper by Nerking (see this vol., ii, 413).

Note by Abstractor.—The method employed of estimating glycogen consisted in extracting the tissues with boiling potassium hydroxide; the proteid in this extract was precipitated with Brücke's reagent, and the glycogen in the filtrate precipitated with alcohol. This precipitate was weighed in some experiments, and converted into sugar in others, the number in the latter case coming out smaller than in the former; the precipitate produced by alcohol, therefore, consisted of something else in addition to glycogen, indeed the author admits it contained nitrogen. He seems altogether to have omitted a consideration of Pavy's work who has shown that proteids on treatment with potash yield an amylose carbohydrate; it appears possible that what is in the present paper called glycogen may, in part at any rate, consist of this substance. W. D. H.

Chemistry of Vegetable Physiology and Agriculture.

Alcoholic Fermentation without Yeast Cells. V. and VI. By Eduard Buchner and Rudolf Rapp (*Ber.*, 1898, 31, 1084—1090; 1090—1094. Compare this vol., ii, 127).—Quantitative experiments with yeast extract show that the relation between the alcohol and carbonic anhydride produced by its action on sugar is practically the same as when living yeast is employed. The active enzyme is not extracted when the yeast is simply washed with water, a comparison of the extracts obtained from washed and unwashed yeast showing that when no arsenite is added, the two are equally strong, whilst in the presence of 2 per cent. of arsenious oxide that obtained from the washed yeast has a much more vigorous action.

The addition of 0·55 per cent. of ammonium fluoride causes an opalescence and greatly diminishes the activity of the extract, whilst the nitrate, chloride, sulphate, and hydrazoate of ammonium are without action. Sodium hydrazoate and toluene, both of which are strong antiseptics, have no effect on the progress of the fermentation, and it is proposed to employ 1 per cent. by volume of toluene instead of potassium arsenite. The latter appears to diminish the fermentation of glucose, galactose, and carbohydrates which yield glucose alone on hydrolysis, whilst it has no effect on saccharose and mixtures of glucose and fructose, or glucose and saccharose. It also appears to have a decided effect on dialysed or diluted extract, but no explanation of this action has as yet been arrived at.

The expressed yeast extract has an equally rapid action on maltose, saccharose, *d*-glucose, and *d*-fructose; raffinose is more slowly fermented and *d*-galactose and glycogen still more slowly, whilst lactose and *l*-arabinose are not attacked. Living yeast ferments glucose more rapidly than fructose and does not ferment glycogen. The experiments were carried out with 13 per cent. and in some cases 28 per cent. solutions, and both in the absence of antiseptics, and in the presence of potassium arsenite and toluene. A. H.

Production of Aromatic Substances by Alcoholic Fermentation in Presence of Certain Leaves. By Georges Jacquemin (*Compt. rend.*, 1897, **125**, 114—116).—Although the leaves of most trees do not possess the characteristic odour and taste of the ripe fruit of the same tree, yet such leaves are capable of developing the odour and taste when placed in a liquid undergoing alcoholic fermentation. Apple, pear, and vine leaves have been treated in this manner. The author suggests that the aromatic principle is probably present in the leaves in the form of a glucoside, and that the glucoside is hydrolysed in the one case by an enzyme secreted by the yeast and in the other by an enzyme contained in the ripening fruit.

J. J. S.

Oxydase from Botrytis Cinerea. By J. B. Vincent Laborde (*Compt. rend.*, 1898, **126**, 536—538).—As has been previously shown, *Botrytis cinerea*, which lives as a parasite on grapes, secretes an oxydase which is afterwards found in the must, and also after fermentation in the wine. This oxydase is the cause of the alteration known as "casse brune."

A method of estimating oxydase has been employed which depends on a comparison of the depth of the blue coloration which it yields with guaiacum extract, with the colour produced between iodine and the same extract (0·5 milligram of iodine to 20 c.c. of mixture gives a colour which is taken as unity).

Oxydase is gradually destroyed by atmospheric oxygen and also by heat, the destruction being complete at 85°.

The author finds that the quantity of oxydase left at the end of a fermentation is always less than the quantity originally present, and that the amount left decreases with the length of time taken for the fermentation. The difference in temperature, 25—36°, does not affect the amount. Injurious yeasts and organisms do not appear to affect oxydase. In the case of red wines, the amount of oxydase left is always much greater than in the case of white wines, and may amount to 80—100 per cent. of the amount originally present. J. J. S.

Action of "Flower of Wine" on Sorbitol. By Gabriel Bertrand (*Compt. rend.*, 1898, **126**, 653—656).—The author has repeated and extended his previous experiments and again finds that, contrary to the statement of Matrot, the "flower of wine" (*Saccharomyces vini*), when growing in a nutritive liquid containing sorbitol, gradually destroys the latter and does not convert it into sorbose. This holds good in a variety of conditions and for various juices containing sorbitol. C. H. B.

Saké, the Japanese National Beverage, and the Fungus which produces it. By Ottokar Shieweck (*Bied. Centr.*, 1898, **27**, 140—141; from *Centr. Bakt. Par.*, **1**, ii, 782).—The liquid is prepared by fermenting steamed rice with "koji," which is obtained by mixing rice grains which have been freed from husks, soaked and steamed, with 0·2 per cent. of Tam koji seeds, which are already infected with *Aspergillus oryzæ*. The whole process, which is rather complicated, is described. The final product of the fermentation is pressed in cotton bags, the saké drawn off into tubs, and allowed to ferment further; the pressed residues yield alcohol and are afterwards utilised as manure. Saké, which contains up to 15 per cent. of alcohol, is consumed hot, has the colour of hock, and in taste resembles old Hungarian wine.

It is supposed that the fermentation is caused by special yeasts, in part true yeasts (*Saccharomyces anomalus* and a yeast with round spores), which are mixed with *Aspergillus*. Experiments with different substances showed that *Aspergillus* developed best on rice and worst on apple sections. N. H. J. M.

Fungi which Thrive in Acids. By Carl Wehmer (*Bied. Centr.*, 1898, **27**, 284—285; from *Beitr. Kennt. einheim. Pilze*, **2**, Jena, 1895).—The flakes produced in pure solutions of citric acid are sterile mycelia, which, when transferred to suitable nutritive solutions, eventually fructify and prove to be *Verticillium glaucum*. No other fungi seem to develop in pure citric acid solutions, but when sugar is added, spores of other kinds are readily detected.

In pure tartaric acid solutions, a mould develops which is capable of existing in presence of extraordinarily large amounts of acid. A growth which had developed in a 13·3 per cent. solution was found to produce vigorous citric acid fermentation in sugar solutions. The same fungus, together with *Penicillium luteum*, appeared on lemons, and both fungi are soon observed in saccharine solutions to which citric or tartaric acids have been added. N. H. J. M.

Nutritive Value of Sodium Salts for Fungi. By Carl Wehmer (*Bied. Centr.*, 1898, **27**, 285; from *Beitr. Kennt. einheim. Pilze*, **2**, Jena, 1895).—The statement that, in nutritive solutions for fungi, potassium salts may be replaced [? by sodium salts] is based on a few old, and admittedly imperfect, experiments. It is now shown that *Aspergillus* and *Penicillium* may develop considerably in nutritive solutions containing, besides a non-nitrogenous organic substance and magnesium sulphate, only sodium phosphate and sodium nitrate. The growth was, however, much slower than in similar solutions containing potassium salts. Sodium salts are, therefore, not worthless as foods, but only less suitable than potassium salts.] N. H. J. M.

Physiological Inequality of Fumaric and Maleic Acids: Antiseptic Action of Maleic Acid. By Carl Wehmer (*Bied. Centr.*, 1898, 285; from *Beitr. Kennt. einheim. Pilze*, **2**, Jena, 1895).—Buchner's experiments (Abstr., 1892, 820) with the ammonium salts of fumaric and maleic acids showed that fungi developed with great difficulty in the maleate solution, and this was supposed to indicate that maleic acid is not available as a source of carbon. In the author's experiments, both the free acids and salts were employed. The results show that maleic acid is directly injurious, and that as an antiseptic for mould fungi it is nearly equal to hydrochloric and oxalic acids, whilst its action on bacteria is similar to that of salicylic acid (compare Ishizuka, Abstr., 1897, ii, 276). N. H. J. M.

Physiology and Morphology of the Acetic Acid Bacteria. By W. Seifert (*Bied. Centr.*, 1898, **27**, 123—130; from *Centr. Bakt. Par.*, 1897, **3**, 337—349 and 385—399).—Methylic and isopropylic alcohols are not attacked by *Bacterium Pasteurianum* and *B. Kützingianum.* Amylic alcohol is not attacked by *B. Past.*, but the results with *B. Kütz.* were uncertain. Ethylic and propylic alcohols are converted by both bacteria into acetic and propionic acids respectively, and butylic and isobutylic alcohols are also oxidised. Ethylenic glycol is oxidised to glycolic acid, which, however, checks the development of the bacterium. Both bacteria act very feebly on glycerol as compared with *B. aceti Brown.* Mannitol is not attacked at all by *B. Past.*; *B. Kütz.* converts it into levulose with only slight energy as compared with *B. aceti Hansen* and *B. aceti Brown.* Neither bacterium acts on dulcitol or on levulose or maltose. Dextrose is oxidised by both bacteria to gluconic acid (which retards the activity of the bacteria), and acetic acid to carbonic anhydride and water; propionic and butyric acids, however, do not seem to be attacked.

The effect of the acetic acid bacteria on monatomic primary alcohols seems to diminish as the amount of carbon increases. N. H. J. M.

Action of Light on Diastase, and its Biological Significance. By J. Reynolds Green (*Proc. Roy. Soc.*, 1897, **61**, 25—28. Compare Abstr., 1896, i, 110).—Brown and Morris have pointed out (Trans., 1893, 604) that the amount of diastase in foliage leaves is greater in the early morning than in the latter part of the day, especially after several hours of sunshine; the author now describes experiments which were made to ascertain whether the diminution in quantity during the day is due to the destructive influence of light on the enzyme. The diastatic solutions employed were extract of malt; aqueous solutions of diastase precipitated by alcohol from malt extract; diluted human saliva, freed from mucin; and extracts of foliage leaves. These were preserved by the addition of 0·2 per cent. of potassium cyanide, and, in the author's experiments, were exposed to the action of light during several hours, either to the whole of the spectrum or to a selected part of it. Their hydrolytic power was then determined by digesting them with dilute solutions of soluble starch, or 1 per cent. starch paste, titrating against Fehling's solution, and weighing as cupric oxide the precipitate thus obtained. Control experiments were made in each case, so that any difference in hydrolytic power was attributable solely to the illumination. The sources of the latter were bright sunshine, diffused daylight, and a powerful, naked electric arc.

The results obtained may be summarised as follows. Exposure to the whole of the spectrum during several hours destroys from 20—60 per cent. of the diastase, whilst an increase in the amount of the latter occurs at first, when the ultra-violet rays are cut off; subsequently, however, the enzyme is gradually and completely destroyed. The infra-red, red (720 $\mu\mu$ to 640 $\mu\mu$), orange (640 $\mu\mu$ to 585 $\mu\mu$), and blue (500 to 430 $\mu\mu$) regions gave increases in the amount of diastase of 10·8, 53·5, 4·75 and 20·8 per cent. respectively; the green region from 585 $\mu\mu$ to 500 $\mu\mu$, however, caused a diminution of 15·7 per cent., and a marked decrease was found in the violet region beyond 430 $\mu\mu$, although this was not measured. It is noteworthy that the increase or decrease of diastase in the several cases continued after the solutions were removed from the access of the rays. The deleterious rays were found to be absorbed by the solutions, partly by the diastase, whether boiled or unboiled, and partly by the proteids present. The latter seem to exercise a protective influence; this was determined separately, by adding small quantities of egg-albumin to the extracts, and appears to be roughly proportional to the amount of albumin present. The colouring matter of barley also acts as a protection.

The author finds also that diastase is destroyed by light in the living leaf, as well as in the extracts, but was unable to determine the probable protective influence of the chlorophyll in the leaf.

The following conclusions are drawn from the experiments. (1) That there exists in the leaf, and in the extracts examined, a certain amount of zymogen, which is converted by the infra-red, red, orange, and blue rays into active diastase. (2) That diastase is destroyed by the ultra-violet and violet rays, or its configuration is so changed that it is unable to effect starch hydrolysis. (3) The enzyme is not located in the chlorophyll grains, but in the protoplasm of the cell. (4) The suggestion of Pick (*Bot. Centr.*, **16**, 9—12), and of Johow (*Pringsheim's Jahrb.*, **15**, 299), that the red colouring of certain leaves is a material help to the translocation of starch, is probably sound, as such colouring matters absorb the rays which destroy the diastase. (5) That the power of utilising the radiant energy of light is possessed by many plants, without the presence of a chlorophyll apparatus.
W. A. D.

Alcohol Production during the Intramolecular Respiration of Higher Plants. By Emil Godlewski and F. Polzeniusz (*Bied. Centr.*, 1898, **27**, 135; from *Anzeiger Akad. Wiss. Krakau*, 1897).—Ten pea seeds kept in a vacuum, with water, yielded daily 10—20 c.c. of carbonic anhydride for three weeks. The total amount of carbonic anhydride obtained in six weeks, when there was no further evolution, amounted to 20 per cent. of the dry substance of the seeds. An amount of alcohol was simultaneously produced corresponding very well with the quantity which would be obtained by ordinary fermentation. When 2 per cent. glucose was used instead of water, there was an increased production of alcohol and carbonic anhydride owing to the partial decomposition of the glucose. Cane-sugar was inverted by the seeds in absence of air.

When kept in water (without air) for 14 days, peas still retain the power of germinating, but germination is not normal, and the roots die before the plumula.

It is concluded that the action of yeast differs only quantitatively from that of the intramolecular respiration of plants.
N. H. J. M.

Anatomy and Physiology of the Seed of Sugar Beet (*Beta vulgaris*). By ANTON NESTLER and JULIUS STOKLASA (*Bied. Centr.*, 1898, **27**, 115—117; from *Neue Zeit. Rübenzuckerind*, 1897, **39**, 37).—Nearly the whole of the lime of the seed is contained in the testa, which contains numerous crystals of calcium oxalate. The testa also contains a large amount of pentosans (18·85 per cent. in the dry matter) probably (especially the xylan) chemically combined with much of the cellulose. The seed, excluding the outer testa, contains the following amounts of the different constituents.

Total nitrogen.	Proteid nitrogen.	Fat (without lecithin).	Lecithin.	Cellulose.	Pentosans.	Starch.	Ash.
4·32	3·85	20·02	0·46	2·31	2·26	37·31	3·52

The ash contains (per cent.).

K_2O.	Na_2O.	CaO.	MgO.	Fe_2O_3.	P_2O_5.	SO_3.	SiO_2.
20·14	8·00	3·83	11·20	0·47	43·22	9·02	2·81

The proteids are mainly in the embryo, and sometimes amount to 24 per cent. The fat plays a very important part during germination, and is at this time almost entirely consumed. Lecithin occurs almost exclusively in the embryo and starch mostly in the perisperm. The hemicellulose in the cotyledons presumably contain pentosans (araban) as well as galactose (compare Schulze, *Zeit. physiol. Chem.*, 1896, 392).

The ash constituents (especially phosphoric acid, sulphur, iron, and magnesium) seem to be mostly in combination with organic substances; the potash is supposed to be accumulated in the perisperm, along with the carbohydrates. N. H. J. M.

Cause of the Presence of Oxalic Acid in Sugar-juices. By G. VON KRIES (*Chem. Centr.*, 1897, ii, 921; from *Zeit. Ver. Rübenzuck.-Ind.*, 1897, 755—757).—In connection with Rümpler's observation (*Deutsch. Zuck.-Ind.*, 1897, 678), that sugar solutions which contain at least 1 per cent. of calcium oxide are able to dissolve calcium oxalate at the ordinary temperature, the author finds that the presence of alkali carbonates enables the juices to hold oxalic acid in solution or to extract it from the sediment. E. W. W.

Substances contained in the Trunks of Trees. By FRANCIS H. STORER (*Chem. Centr.*, 1897, ii, 902—903; from *Bulletin of the Bussey Institution*, **2**, 386, 408).—The author finds that the quantity of starch stored in the trunks of trees is not so great as is usually assumed and that pentosans are to be regarded as the reserve material. The following data in parts per 100 of wood dried at 100° were obtained in the case of white birch (*Betula populifolia*).

	Inner wood.		Outer wood.		Bark.	
	Pentosan.	Starch.	Pentosan.	Starch.	Pentosan.	Starch.
In May	39·23	4·93	36·10	5·42	30·82	7·67
In July	30·52	3·83	34·67	3·87	21·07	7·52
In October...	29·83	3·75	29·97	3·51	22·67	4·24

The amount of pentosan was estimated by distilling the wood with hydrochloric acid of sp. gr. = 1·06 and weighing the furfuraldehyde in the form of its phenylhydrazine compound; when 2·5 per cent. or a still more dilute acid was used, and the sugar estimated by Allihn's method, the more dilute the acid the less the amount of pentosan obtained and the residue when distilled with acid of sp. gr. = 1·06 gave abundance of furfuraldehyde. The starch was estimated from the amount of sugar obtained by the action of diastase. The content of wood-gum determined by Loew's method was found to be 13—14 per cent. in the wood and 6·8 per cent. in the bark, and the crude fibre by Weende's method 52·5—55·2 in the wood. This crude fibre also contains pentosan and yields furfuraldehyde when distilled with hydrochloric acid. Lange's method gave similar results and the cellulose was also found to contain pentosan. E. W. W.

Feeding Experiments on Milch Cows with Linseed Oil and Crushed Linseed. By D. MELIK. BEGLARIAN (*Bied. Centr.*, 1898, **27**, 239—240; from *Milchzeit.*, 1897, 552).—Four cows were fed during four periods of 8 days as follows. Period (1 and 4), beetroot, 50 kilos.; hay, 14 kilos.; straw, 3 kilos.; malt germs, 4 kilos.; linseed meal, freed from oil, 4 kilos.; and barley meal, 2 kilos. per 1000 kilos. live weight. Period (2), the same as (1 and 4), with linseed oil (1 kilo.), as an emulsion, in addition. In period (3) the feeding was the same as in (1 and 4), except that crushed linseed (4 kilos.) was substituted for linseed meal.

The emulsified oil caused loss of appetite, but the crushed linseed was eaten readily. As regards the effect of the oil, or oily food, on the production of fat, the results were, unlike Soxhlet's, entirely negative.

It is considered that further experiments are desirable. (Compare Soxhlet, *Wochenbl. landw., Ver. Bayern*, 1896, and *Journ. R.A.S.E.*, 1897, [iii], **8**, 655; also Speir, *Trans. Highland and Agric. Soc. Scotl.*, 1897, [v], **9**). N. H. J. M.

Manuring Experiments with Potash and Soda. By SMETS and C. SCHREIBER (*Bied. Centr.*, 1898, **27**, 227—229; from *Recherches sur les engrins potassiques et sodiques, Maaseyck.*, 1896).—The exclusive application of sodium salts to soil very poor in available potash has little or no effect on the vegetation, but has a distinct effect in the case of soils containing a moderate amount of potash. With poor soils, sodium salts should be applied along with potassium salts. In presence of much potash, soda is without effect. Soda is useful in economising potash, but is not necessary to vegetation.

Experiments with oats on different soils showed that the soda in kainite and carnallite has an effect between 5 and 80 per cent. of the effect produced by the potash. Other experiments, with different crops, indicated an effect produced of 6 to 36 per cent. of that shown by the potash. N. H. J. M.

Analytical Chemistry.

Estimation of Perchlorate in Saltpetre. By R. SELCKMANN (*Zeit. angw. Chem.*, 1898, 101—102).—Five or 10 grams of the sample of Chili-salpetre which has been assayed for chlorides is fused in a porcelain crucible of 40—50 c.c. capacity with 3—4 times its weight of lead-cuttings. Soon after the nitrate fuses, the lead begins to melt, and evolution of oxygen and formation of litharge is noticed. To promote the action, the mass is well stirred with a bent copper wire, and when, after about 15 minutes, the mixture has become pasty, the heat is raised for a few minutes to dull redness. When cold, the melt is warmed with water containing a few grams of sodium hydrogen carbonate or hydroxide, and the filtrate containing the chlorine is acidified with nitric acid, precipitated with silver nitrate, and the silver chloride collected and weighed.

When dealing with ordinary salpetre, the heating should be conducted cautiously at first, and finally somewhat more strongly for half an hour, to completely decompose the perchlorate. The test-analyses are satisfactory. L. DE K.

Detection of Iodine in Organic Preparations. By ANTON SEYDA (*Chem. Centr.*, 1897, ii, 806—807; from *Zeit. öffentl. Chem.*, 3, 359—364).—*In Cod-liver Oil.*—Twenty grams of the sample is thoroughly mixed with 40 grams of powdered sodium hydroxide contained in a nickel dish of 200 c.c. capacity, and then heated over a burner. After the first frothing is over, the dish is covered with a platinum lid and the heat is continued for 8 hours, the mass being from time to time stirred with a clean iron spatula. The residue is then transferred to a beaker and dissolved in 400 c.c. of water, and after removing the carbonaceous residue by filtration, a current of carbonic anhydride is passed into the filtrate until the alkali is completely neutralised, which may be ascertained by the well-known barium chloride test. When cold, an equal volume of commercial absolute alcohol is added to precipitate the sodium carbonate, which is collected, and washed thrice with proof spirit. The mixed alcoholic liquid is then concentrated on the water bath, transferred to a platinum dish, and again carefully evaporated to dryness, and gently ignited until it becomes white. When cold, it is dissolved in a little water, and mixed in a separating funnel with 5 c.c. of a 0·01 per cent. solution of potassium nitrite, 10 c.c. of chloroform is added, and the whole well shaken; the liquid is then acidified with dilute sulphuric acid, and again thoroughly shaken. When the two layers have completely separated, the chloroform is drawn off and filtered into a glass cylinder of 10 cm. diameter through a dry filter. The presence of iodine is indicated by the characteristic purple coloration of the chloroform, which is rendered more visible by comparing it with a similar cylinder containing pure chloroform.

In Oophorin.—This pharmaceutical preparation is prepared from pigs' ovaries. Twenty grams of the sample is treated as directed for cod-liver oil. A sample analysed by the author showed, however, no trace of iodine. L. DE K.

Test for Sulphurous Acid: Estimation of Iron with Dichromate. By H. JERVIS (*Chem. News*, 1898, 77, 133).—In reducing ferric solutions with sulphurous anhydride, the complete expulsion of the excess of the gas is best ascertained by testing the vapour from the boiling liquid with a few drops of a very dilute acid solution of permanganate.

It has been suggested that traces of iron may be estimated in ignited manganese oxide by dissolving in hydrochloric acid, reducing, and titrating with dichromate. This is not correct, as in presence of much manganous salt the blue colour of the ferrous ferricyanide is not seen, being masked by the brown manganous ferricyanide.

D. A. L.

Valuation of Fuming Sulphuric Acid and of Sulphuric Anhydride.—By R. ROSENLECHER (*Zeit. anal. Chem.*, 1898, 37, 201—217).—The following method was devised for the rapid assay, for technical purposes, of numerous samples of the above substances, by operators not accustomed to refined analytical work. From a glass tube 5—6 mm. in diameter, light bulbs, each with two narrow tubes, are drawn out; while expanding each bulb, its tubes are bent out from a straight line to an angle of about 140°, and their ends are then reduced in bore to $\frac{1}{4}$ to $\frac{1}{2}$ mm. It is convenient to have one tube 4—5 c.m., the other 5—6 c.m., in length. Plunging the longer tube into the sample of acid (previously, if necessary, completely liquefied, by suitable, but not excessive, warming in a stoppered bottle), it is easy by suction to draw some of the acid into the bulb without any of the white anhydride fumes passing beyond it. The bulbs can be hung from the balance in an appropriate wire stirrup, and owing to the narrowness of the tubes neither loss of anhydride nor absorption of water is to be feared during the weighing. Warming the bulb by the hand is naturally to be avoided. Each bulb is then thrust into a bottle (250—300 c.c.) containing 20—30 c.c. of distilled water and 10 drops of an indicator (paranitrophenol is preferred) and held horizontally. It is easy to insert the stopper and seal it by wetting with the water inside before any escape of acid occurs. A sudden shake then pulverises the bulb, and the white fumes which fill the bottle are allowed to disappear by absorption before the stopper is removed. The titration with alkali is then completed in the same bottle. Duplicate assays seldom differ by more than a few hundredths per cent. M. J. S.

Iodometric Estimation of Tellurium. By JAMES F. NORRIS and HENRY FAY (*Amer. Chem. J.*, 1898, 20, 278—283).—The following method affords an accurate means for the estimation of tellurium in presence of the halogen acids.

Tellurous acid is oxidised to telluric acid by adding potassium permanganate until the meniscus of the brown solution shows a deep pink colour. The whole is then diluted with ice-cold water, treated with potassium iodide and sulphuric acid, and titrated with sodium thiosulphate. The oxidation of tellurium may be expressed by the following equation, $2KMnO_4 + 3TeO_2 + 4KI + 5H_2SO_4 = 3TeO_3 + 3K_2SO_4 + 2MnSO_4 + 5H_2O + 4I$.

The authors find that pure, perfectly white, tellurium dioxide may be obtained by decomposing the basic nitrate just below a red heat and then fusing quickly in small portions. If the nitrate be fused directly, traces of tellurium always separate. A. W. C.

Method for Estimating Free Acid in the Presence of Phosphates. By L. DE JAGER (*Chem. Centr.*, 1897, ii, 683—684; from *Centr. med. Wis*., 1897, 593—596).—The process is very much like the well-known method proposed by Leo; it is carried out by titrating the boiling solution with N/10 soda, using phenolphthalein as indicator, the liquid turning red the moment all the lime has been precipitated as tricalcium phosphate. If no lime is present, another estimation must be made after adding some calcium chloride.

If free lime is present, this is quantitatively removed by oxalic acid, and another titration is made. Formulæ are given to facilitate the calculation. L. DE K.

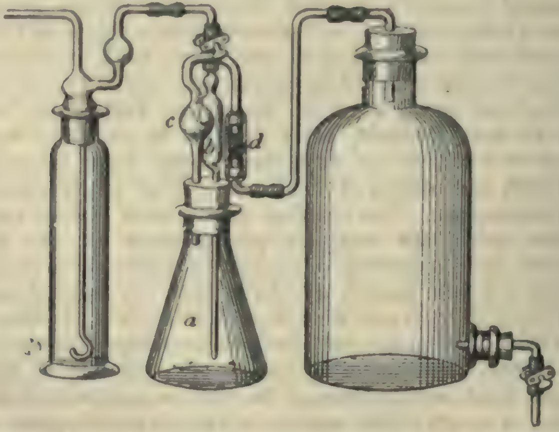
A Gravimetric Method of Estimating Phosphoric Acid as Ammonium Phosphomolybdate. By THOMAS S. GLADDING (*Chem. News*, 1898, **77**, 32—33. Compare Abstr., 1896, ii, 336).—The author obtains a uniform molybdate precipitate in the following manner, and approves of its use for the estimation of phosphoric acid. Twenty-five to 50 c.c. of the phosphoric solution is treated with 25 c.c. of ammonia, of sp. gr. 0·900, then acidified with nitric acid, of sp. gr. 1·420, and placed on a water bath maintained at 50°, while the ordinary 5 per cent. acid molybdate solution is dropped in with constant stirring, at the rate of 50 c.c. in 5 minutes, until there is an excess of 10 c.c.; after a further 10 minutes on the water bath, the mass is filtered through a weighed filter. The filtrate is mixed with 5 c.c. of molybdate solution, and should remain clear or become only slightly opalescent after being on the water bath 10 minutes. The precipitate is washed with dilute nitric acid (100 : 1), three times by decantation, and three times on the filter, and finally once with water; it is then drained, dried first in an ordinary water oven, and finally at 105°, in an oven surrounded with dilute glycerol, sp. gr. = 1·160, and boiling at 110°. The filter paper must be tared to that temperature. The various precautions ensure the absence of occluded salts, the complete precipitation of the phosphoric acid, and the non-separation of molybdic oxide or iron salt. The author finds the composition of the yellow crystallised salt to be: $24MoO_3,P_2O_5,3(NH_4)_2O + 24MoO_3,P_2O_5,2(NH_4)_2O,H_2O + 5aq$.

For the direct estimation of reverted or citrate-soluble phosphoric acid, the citrate filtrate and washings are made up to 200 c.c. and 25 c.c., equivalent to 0·25 gram of the fertiliser, is treated with 50 c.c. of ammonia, of sp. gr. 0·900, acidified with nitric acid, made up to half a litre, heated in a bath to 65°, while 50 c.c. of molybdate solution is added in a thin stream with stirring, the whole digested for half an hour, and then treated as above, except that the filtrate is heated for half an hour at 65°, when it should remain clear. D. A. L.

Volumetric Estimation of Phosphoric Acid. By AUGUST HEBEBRAND (*Zeit. anal. Chem.*, 1898, 37, 217—223).—The method advocated is essentially that of Stolba (Abstr., 1877, ii, 355), and possesses the advantage over the gravimetric estimation as magnesium pyrophosphate, that it gives identical results with monammonium magnesium phosphate, and with diammonium magnesium phosphate, $(NH_4)_4MgP_2O_8$, the admixture of the latter with the precipitate of the former having been recognised by Neubauer as the chief source of error in the gravimetric method. The precipitate obtained in the usual manner is collected in an ordinary filter, and after washing sufficiently with 2·5 per cent. ammonia, the ammonia is displaced by washing with about 30 c.c. of 96 per cent. alcohol. The still moist precipitate is then rinsed back into the precipitation beaker and treated with a small measured excess of N/5 hydrochloric acid, in which it readily dissolves. About 5—10 drops of an alcoholic solution of Merck's carminic acid (0·5 gram in 100 c.c.) is added as an indicator, and the excess of acid is titrated back with N/5 sodium hydroxide. The change of colour from yellowish-brown to violet occurs when one atom of the hydrogen of the phosphoric acid has been replaced by metal, so that the factor 0·0071, multiplied by the number of c.c. of N/5 acid consumed, gives the weight of P_2O_5 in grams. Some practice is required to recognise the point at which the colour changes, and an indicator acting more sharply would be an improvement, but the results quoted leave little to be desired on the score of accuracy.

M. J. S.

Apparatus for the Estimation of Carbonic Anhydride. By GEORG F. KUNTZE (*Chem. Centr.*, 1897, ii, 637—638; from *Pharm. Centr. H.*, 38, 509—511).—The apparatus consists of an Erlenmeyer flask, *a*, which contains the substance to be tested, and serves as a generating flask. It is made in such a way that it stands perfectly steady on the balance. The pipette, *b*, which holds the acid, is bent sideways, and provided with an elongated bulb to prevent accidents;



when filling, it is closed by means of an india-rubber tube fitted with a screw clamp. The drawn-out part does not dip into the liquid in the flask. A duplex condenser, *c*, resembling a Peligot bulb tube, with an S-shaped tube at its end, serves to carry off the evolved carbonic acid. This arrangement prevents any undue excess of moisture from getting into the calcium chloride tube, *d*, as it nearly all condenses in the bulb or the S-tube.

The calcium chloride tube is fitted with a rectangularly bent and drawn out delivery tube, which is fitted with india-rubber caps when the apparatus is weighed. To make an analysis, 0·5—1 gram of the sample is introduced into the flask and mixed with 2 c.c. of water, care being taken not to get any of the substance on the sides of the flask. The pipette is filled with acid, closed, and put through the india-rubber cork, and the whole weighed; the acid is then allowed to drop on to the carbonate, and the dissolved carbonic anhydride is expelled by warming the flask on an asbestos plate, the last traces being removed by means of the aspirator. L. DE K.

Estimation of Added Alkali in Beer. By EDUARD SPAETH (*Zeit. angw. Chem.*, 1898, 4—5).—The author recommends the following method for the estimation of added sodium carbonate in beer: 500 c.c. of the sample freed from carbonic anhydride is mixed with 100 c.c. of ammonia, and after the earthy phosphates have completely separated, the liquid is filtered, and 60 c.c. of the filtrate (=50 c.c. of sample) is incinerated, and the phosphoric acid estimated by the molybdate method. Another 250 c.c. of the filtrate is mixed with 25 c.c. of basic lead acetate, allowed to settle, and 200 c.c. of the filtrate is evaporated to a small bulk, and then made up again to 200 c.c. After adding a few drops of acetic acid, the excess of lead is precipitated with hydrogen sulphide, and the whole filtered; 150 c.c. of the liquid is evaporated to dryness, the residue incinerated, and the alkali in it estimated with decinormal acid The amount of phosphoric anhydride, multiplied by 1·4, equals the amount of acid necessary for the neutralisation of the normal alkalinity of the sample. L. DE K.

Ammonia-Soda. Analysis of Refuse Liquid. By KONRAD W. JURISCH (*Zeit. angw. Chem.*, 1898, 273—274).—After obtaining a thoroughly representative sample, the following scheme of analysis is recommended. *A*. Twenty-five c.c. of the sample is titrated with normal hydrochloric acid, using litmus as indicator; to completely dissolve the calcium carbonate, warming must be resorted to, if necessary. The result represents the total calcium hydroxide, calcium carbonate, and ammonia. *B*. One hundred c.c. of the sample is mixed with 35 grams of ammonium chloride dissolved in water, and the whole is, after a while, diluted to 1 litre. Five hundred c.c. is then filtered off and titrated with normal acid; this will represent the calcium hydroxide and the ammonia. *C*. Another 100 c.c. of the filtrate *B* is mixed with excess of ammonium carbonate, and then boiled until no more ammonia escapes. The precipitate is collected and titrated with the acid; this represents the calcium hydroxide and any calcium chloride. *D*. One hundred c.c. of the sample is distilled with calcium hydroxide, and the ammonia in the distillate is titrated.

E. Ten c.c. of the sample is diluted to 100 c.c., and of this 10 c.c. is taken and titrated with N/10 silver nitrate to get the amount of chlorine, potassium chromate serving as indicator; any chlorine not in combination with calcium is calculated to sodium chloride. The calculation will be easily understood. Convenient formulæ are given.

L. DE K.

Analysis of Calcium Carbide. By HEINRICH BAMBERGER (*Zeit. angw. Chem.*, 1896, 196—198; 243).—The process is the same as that generally used for estimating carbonic anhydride by the loss in weight. A rather large carbonic acid apparatus, fitted with calcium chloride tube, is charged with 200 c.c. of brine, and this is allowed to drop slowly on to 50 grams of the coarsely-powdered sample. The loss in weight after the action is over represents the acetylene given off.

The apparatus may be connected with the 10-bulb tube devised by Lunge, containing hypochlorite (this vol., ii, 55), and any hydrogen phosphide thus estimated. If it is desired to estimate the volume of the evolved acetylene, this may be conveniently done by allowing brine to act on a weighed quantity of the sample, and collecting the gas in a gasometer filled with brine saturated with acetylene, which is allowed to run out from the bottom into another similar reservoir. When the action is over, the liquid in the two reservoirs is brought to the same level, and the volume of the gas is read off.

L. DE K.

Estimation of Lead and Antimony in Tin-foil. By ANTON SEYDA (*Chem. Centr.*, 1897, ii, 810—811; from *Zeit. für öffentl. Chem.*, 3, 364—371).—*Estimation of Lead.*—Ten grams of the foil is dissolved in about the calculated amount of warm 25 per cent. hydrochloric acid. If more than 1 per cent. of antimony is present, this will be for the most part left undissolved; about the calculated amount of 25 per cent. nitric acid is now added, which dissolves the antimony and peroxidises the tin. The liquid is then slowly poured into a little more than the calculated quantity of hot 25 per cent. aqueous soda, which should cause an almost clear solution to form; after adding a little precipitated sulphur, hydrogen sulphide is passed in until the liquid becomes of a clear yellow. After 24 hours, the black precipitate of lead sulphide is thoroughly washed with hot yellow sodium sulphide, and then converted into lead sulphate by the action of nitric and sulphuric acids.

Separation and Estimation of Antimony.—One hundred c.c. of fuming nitric acid is put into a flask, and a small portion of 5 grams of the foil is introduced; 25 c.c. of water is added to start the action, and then gradually the remainder of the tin. The oxides thus formed are transferred to a porcelain dish, the flask rinsed with 25 per cent. nitric acid, and after evaporating to dryness, and drying for some time at 100°, the oxides are gradually introduced into 60 grams of sodium hydroxide, previously heated to fusion. This causes the formation of sodium stannate and antimonate, which are separated in the usual way by means of weak alcohol; the insoluble antimony compound should be again fused with 10 grams of sodium hydroxide. The antimony sulphide obtained later on from the sodium compound may contain lead, copper, iron, nickel, &c., and should be digested with sodium sulphide solution. On adding acid, the antimony sulphide should be precipitated with its characteristic orange colour.

L. DE K.

Analysis of Aluminium. By FR. SIBBERS (*Chem. Centr.*, 1897, ii, 808—810; from *Pharm. Zeit.*, **42**, 622).—The author states that, when dissolving aluminium in hydrochloric acid, as much as 0·3 per cent. of the silicon may volatilise as hydrogen silicide; this silicon may, however, be to some extent recovered by dissolving the metal in a small flask, from which the air has been previously expelled by a current of hydrogen free from silicon. The delivery tube consists of two parts, a calcium chloride tube, and a weighed tube, bent rectangularly downwards and not drawn out to a point. On igniting the hydrogen, the silicon burns to silica, which is deposited on the outer side of the tube.

L. DE K.

Separations from Chromic Acid: I. Separation of Iron; II. Separation of Manganese. By HARRY BREARLEY (*Chem. News*, 1898, **77**, 49—50, 131—133. Compare this vol., ii, 143).—*Separation of Iron.*—On boiling from 50 to 120 c.c. of a solution of potassium chromate containing 12½ grams per litre with 1 gram of iron as ferric chloride, a precipitate forms which cannot be filtered, but settles completely after some days; an examination of the supernatant liquor shows, however, that the separation of the iron and chromium is imperfect; moreover, the precipitate gradually re-dissolves in the cold, first becoming less and less basic; later the iron and chromium dissolve proportionately. When a gram of iron as an acid solution of ferric chloride was precipitated hot with an equivalent amount of sodium carbonate, the chromate added, and the solution made up to a litre and boiled, the liquor separated by fractional precipitation showed chromium increasing with the amount of chromate added, but even with 100 c.c. the separation was imperfect. With 1 gram of iron and 30 c.c. of chromate solution, the whole being made up to a litre, complete separation could be obtained by the use of 2N alkali in excess, that is, more than 50 of ammonia, 50 of sodium carbonate, or 30 of sodium hydroxide.

Separation of Manganese.—Half a gram of manganese as manganous chloride, along with 50 c.c. of the chromate solution, acidified and diluted to half a litre, was used in these experiments. With sodium hydroxide, the recovery of chromium increased with the quantity of alkali, but was worse in hot than in cold solutions; in all cases, the manganous hydroxide absorbed oxygen from the air, although this was less marked in hot solutions. With bromine and ammonia, the separation improves with the quantity used, in fact, an approximately accurate separation can be effected by using large quantities of these reagents. With 10 c.c. of 2N sodium carbonate, the chromium recovery was complete from solutions treated in the cold and filtered without heating, and nearly so from cold solutions heated to boiling before filtration, but far from perfect from boiling solutions in which, too, contrary to the behaviour of any other precipitant, an increased excess gave a decreased recovery. With sodium phosphate, the separation of manganese and chromium is complete when an excess of 50 per cent. of disodium phosphate is used, 20 c.c. or more of normal ammonia added, the precipitate allowed to settle, and the solution syphoned and filtered off, if chromium alone is sought; or the phosphate precipitate may be re-dissolved in hydrochloric or sulphuric acid, the ammonia added, and the precipitate left to crystallise if the manganese is also to be estimated. D. A. L.

[Detection and Estimation of Thorium.] By GREGOIRE N. WYROUBOFF and AUGUSTE VERNEUIL (*Compt. rend.*, 1898, **126**, 340—343).—See this vol., ii, 339.

A Method of Estimating Acetylene applicable to Hydrocarbons of the type RC⁝CH. By R. CHAVASTELON (*Compt. rend.*, 1896, **125**, 245—246. Compare Abstr., 1897, i, 545).—Acetylene reacts with an excess of silver nitrate in either aqueous or alcoholic solution according to the equation $C_2H_2 + 3AgNO_3 = C_2Ag_2,AgNO_3 + 2HNO_3$.

The author suggests this as a basis for estimating the amount of acetylene in gaseous mixtures, namely, by titrating the amount of nitric acid liberated. The gas must be free from acid vapours, and the operation is best caried out in a Raoult absorption eudiometer. The method is a general one for hydrocarbons of the type RC⁝CH.

J. J. S.

Analysis of Acetylene. By WALTHER HEMPEL and LEOPOLD KAHL (*Zeit. angw. Chem.*, 1898, 53—55).—The most dangerous impurity in acetylene is hydrogen phosphide, to estimate which the authors, after many trials, now recommend the following process. The gas is measured over mercury and then transferred to a gas pipette partially filled with mercury, and containing 3 c.c. of a solution of copper sulphate, made by dissolving 15·6 grams of crystallised copper sulphate in 100 c.c. of water, and adding 5 c.c. of dilute sulphuric acid (1 : 4). Before use, it should be saturated with pure acetylene. After 3 minutes contact, with continuous shaking, the gas is again transferred to the burette and measured. One-fourth of the loss in volume equals the hydrogen phosphide. L. DE K

Estimation of Ethereal Oils in Aromatic Waters. By HEINRICH BECKURTS and G. FRERICHS (*Chem. Centr.*, 1897, ii, 716; from *Apoth. Zeit.*, 12, 563—564).—The ethereal oil is extracted with ether, the liquid concentrated to 10—15 c.c., and the remainder of the ether removed by passing a current of dry air over it until the ice which always forms has disappeared. In this manner, the amount of oil in fennel and peppermint waters was found to be 0·06 per cent. On account of the very limited solubility of ethereal oils, the so-called concentrated waters invariably contain alcohol.

L. DE K.

Method for Estimating Chloroform in Viscera. By ANTON SEYDA (*Chem. Centr.*, 1897, ii, 815; from *Zeit. offentl. Chem.*, 3, 333—337).—The viscera, after being cut up, are introduced into a distilling flask, made into a thin paste with water containing tartaric acid, and the chloroform distilled off by heating on a sand bath and passing in steam. The vapours are passed through a condenser and then collected in a 50 c.c. flask; when three parts filled, the receiver is changed and the distillation is stopped when the distillate no longer gives any chloroform reaction. The mixed distillates are then made up to 50 c.c., and in 10 c.c. the chloroform is estimated colorimetrically, five cylinders containing various known weights of chloroform being used for comparison.

The colorimetric estimation is conducted as follows: 1·4 grams of chloral hydrate (= 1 gram of chloroform) is dissolved in a litre of water; before use this is diluted to 10 times its bulk. A 10 per cent. aqueous solution of resorcinol and a 25 per cent. aqueous soda are also prepared; 1 to 10 c.c. of the chloral solution is mixed with 2 c.c. of the resorcinol and 1 c.c. of the soda solution; and the tubes containing this and the unknown solution are heated in the water bath for 10 minutes at 80°, when the red coloration due to the reaction between the resorcinol and the chloroform will have fully developed.

L. DE K.

Estimation of Methylic Alcohol in Ethylic Alcohol. By A. LAM (*Zeit. angw. Chem.*, 1898, 125—130).—Twenty-five c.c. of the spirit, the sp. gr. of which should be about 0·935, is treated in a distilling flask with 5 grams of amorphous phosphorus and 40 grams of iodine. When the action is over, the contents are distilled and the iodides formed are first washed with weak aqueous soda, then with water, and finally dried over calcium chloride. After noting the volume, the sp. gr. is carefully taken, and the amount of methylic iodide ascertained by referring to the tables given in the original paper.

The sp. gr. of methylic iodide is 1·9444; that of ethylic iodide 2·2677.

L. DE K.

Fehling's Solution. By OTTO ROSENHEIM and PHILIP SCHIDROWITZ (*Chem. News*, 1898, 7, 97).—With reference to Jovitschitsch's statement that mineral acids reduce Fehling's solution (this vol., ii, 98), the authors have failed to observe any such reduction either when following Jovitschitsch's directions, or when boiling 25 c.c. of freshly prepared Fehling's solution for 1 minute with hydrochloric, sulphuric, or nitric acid, or when a constant volume of the solution was first acidified with a slight excess of hydrochloric, sulphuric, nitric, or tartaric acid and fresh Fehling's solution added until the reaction was distinctly alkaline to litmus; under the latter conditions, the solutions remained perfectly clear in the cold, but on boiling a slight turbidity not increased by vigorous boiling for 4 minutes was produced, and was due to the separation of a small quantity of hydrated cuprous oxide mixed with organic matter; after the removal of this by filtration, the solution did not give a further precipitate when again boiled.

D. A. L.

Estimation of Lactose in Milk. By ALFRED ORTMANN (*Chem. Centr.*, 1897, ii, 814—815; from *Zeit. Nahrungsm. Hyg. Waar.*, 11, 265—266).—Obermayer recommended precipitation of the proteids in milk by means of trichloracetic acid and subsequent estimation of the lactose by precipitation. The author has compared this method with the process used by Soxhlet, who precipitates the proteids by copper sulphate and then estimates the lactose gravimetrically by means of Fehling's liquid. The results obtained were very concordant.

L. DE K.

Polarimetric Method for the Estimation of Starch in Flour, &c. By EDWIN DOWZARD (*Chem. News*, 1898, **77**, 107—108).—A malt extract is used capable of transforming an equal weight of potato starch (as mucilage) into dextrin and maltose in 20 minutes at 40·5°. Fifty grams of the extract is dissolved in 500 c.c. of cold water, 5 grams of washed kaolin added, and the mixture agitated and filtered. A gram of flour is mixed with a small quantity of cold water, then with 35 c.c. of boiling water and kept at 100° for 30 seconds, cooled to 48°, treated with 20 c.c. of the clear malt solution, maintained at 48° for 20 minutes, heated just to the boiling point, and filtered. The filtrate is made up to 100 c.c., some kaolin added, the whole filtered, and the clear solution examined in a 20 cm. tube in an instrument of the Laurent half-shadow type, the reading less the rotation due to the malt solution and to any initially optically active matter in the flour gives a number from which the amount of starch is readily calculated.

D. A. L.

Detection of Picric Acid in Beer. By A. RUPEAU (*Chem. Centr.*, 1897, ii, 813; from *Rev. Intern. Falsif.*, **10**, 125—126).—Two test-tubes are respectively filled with 10 c.c. of pure beer and beer containing picric acid. To each is now added 1 c.c. of a 2 per cent. solution of potassium cyanide and 1 drop of aqueous soda; the mixture is heated nearly to boiling and the colours are observed. In this manner, 0·01 gram of picric acid per litre may be recognised.

Another test consists in using a reagent composed of 5 grams of iron sulphate, 5 grams of tartaric acid, and 200 c.c. of brine. 0·5 c.c. of the sample is allowed to flow on to 1—2 c.c. of the reagent and 2 drops of ammonia are added and the whole slightly shaken. In the presence of picric acid, a reddish coloration will be noticed This test will show 0·005 gram of picric acid per litre.

L. DE K.

Preparation of Ammonium Tartrates and Citrates free from Lead. By LEONARD DE KONINGH (*Chem. News*, 1898, **77**, 119).—The author finds that lead cannot be removed completely from ammonium hydrogen tartrate by long continued washing or repeated recrystallisation. The best plan of removing lead or copper from ammonium tartrate or citrate is to treat the alkaline solution with hydrogen sulphide as long as the colour intensifies, then agitate with a little kaolin and filter, passing the filtrate through purified animal charcoal to remove any yellowness, and repeating the treatment with hydrogen sulphide and kaolin if necessary. It is not supposed that all the lead or copper can be removed in this manner, but it furnishes a liquid that may be used for comparison in Warington's process.

D. A. L.

The Iodine-addition Method. By J. J. A. WIJS (*Ber.*, 1898, **31**, 750—751).—Instead of Hübl's solution for determining the iodine number of oils, the use of a solution of iodine chloride is proposed. This is made by dissolving 13 grams of iodine in 1 litre of 95 per cent. acetic acid, estimating the oxidising strength of the solution by titration with N/10 thiosulphate, and passing in chlorine gas, washed free from hydrogen chloride, until this oxidising strength is doubled; after a little practice, one can recognise this point by the change in colour. Twenty-five c.c. of such a solution require 56·46 c.c. N/10 thiosulphate; after 96 hours, 56·28 c.c.; and after 72 hours more, 56·27 c.c. This solution is used in the same way as Hübl's reagent, except that less potassium iodide need be added for the titration (10 c.c. of a 10 per cent. solution suffice). The new method gives more constant results than Hübl's, and they are just a little higher. A saving of time is also effected; whereas with Hübl's solution 4 hours are required, with the new solution the addition of the iodine is always complete in 10 minutes, and even in 3—4 minutes in the case of oils with a low iodine number. With specially purified allylic alcohol, and using 75 per cent. excess of the solution, the number 434·1 was obtained after 5 minutes action, and 436·8 after 10 minutes; with Hübl's solution in similar excess, the number 425 was obtained after 20 hours; the theoretical number is 435. C. F. B.

Colour Reaction of Sesame Oil by means of Furfuraldehyde and Hydrochloric Acid. By L. van der Grinten and by Oskar Hagemann (*Bied. Centr.*, 1898, **27**, 283—284).—The recent German margarine law requires manufacturers to add 10 per cent. of sesame oil to margarine, to enable the latter to be distinguished from butter. Fat containing as little as 0·5 per cent. of sesame oil, when shaken with an equal volume of fuming hydrochloric acid (sp. gr. 1·19) and a few drops of a 2 per cent. alcoholic furfuraldehyde solution, gives a distinct red colour to the hydrochloric acid.

Van der Grinten (*Milchzeit.*, 1897, 554) remarks that, since it has become known that human urine is used in the production of annatto, other dyes, such as curcuma and coal-tar dyes, have been adopted for the purpose of colouring butter. [Kreusler states that saffron is chiefly employed]. As these dyes give the same colour reaction as sesame oil, butter coloured with them is liable to be rejected as artificial.

Hagemann, in reply, points out that the colour reactions cannot be mistaken. Curcuma solutions are coloured by strong hydrochloric acid alone, and on diluting the yellow colour returns.

N. H. J. M.

Colour Reaction of Sesame Oil. By Vittorio Villavecchia and Guido Fabris (*Chem. Centr.*, 1897, ii, 772—773).—See this vol., i, 445.

Polimanti's Method of Estimating Fat. By Joseph Nerking (*Pflüger's Archiv.*, 1898, **71**, 427—430).—In contradiction to Polimanti (this vol., ii, 317), the author maintains that simple extraction with ether does not give a correct result, and that the only trustworthy method is the Pflüger-Dormeyer one, in which a preliminary gastric digestion is performed. W. D. H.

Analysis of Fats. By WILHELM FAHRION (*Zeit. angw. Chem.*, 1898, 267—273).—The author states that when shaking a solution of fat in alcoholic potash with light petroleum to extract any mineral oil, it is advisable to first neutralise any excess of alkali that may be present.

To estimate the amount of unsaponifiable matter in wool grease, 2 grams of the sample is heated in a porcelain basin with 10 c.c. of 2N alcoholic soda, and evaporated to dryness on the water bath, the residue being moistened with strong alcohol and again dried; the dry soap is then dissolved in 70 per cent. alcohol, neutralised with normal hydrochloric acid, and shaken with six successive portions of 20 c.c. of light petroleum. Each time, the latter is washed with 10 c.c. of 50 per cent. alcohol to remove any soap, and the alcoholic liquid returned to the main bulk. The petroleum extractions are mixed, or may be evaporated separately; the last portion should then yield but a mere fraction of residue.

Alcoholic solutions of soap yield a small quantity of soap to light petroleum, particularly in the presence of alkali; this may, however, as stated, be removed by washing with dilute alcohol. Dry soap, whether neutral or alkaline, seems quite insoluble in light petroleum.

The author has also experimented on the solubility of light petroleum in dilute alcohol. If the alcohol is diluted to 70 per cent., the solubility is practically nil, but if soap is present to the extent of 10 per cent., every 10 c.c. of the liquid dissolves 1 c.c. of light petroleum. This fact explains the great difficulty experienced in completely freeing the soapy liquid from unsaponifiable matter by agitating with light petroleum. If difficulty is experienced in the separation of the two layers, this may be remedied by adding more alcohol; more petroleum then, however, passes into the alcoholic liquid, and the shaking must be more frequently repeated. The author now proposes to combine the estimation of unsaponifiable matter with the taking of the saponification number. Three to four grams of the fat is dissolved in 25 c.c. of light petroleum and 25 c.c. of approximately normal alcoholic potash (free from water) is added. After remaining overnight, phenolphthalein is added and the liquid carefully neutralised with N/2 hydrochloric acid, and the saponification number calculated from the result. The liquid is now put into a separating funnel, and sufficient water is added to reduce the alcohol to half strength. Any mineral oil is then extracted by repeated agitation with light petroleum as directed.

A table is given showing the percentage of unsaponifiable matter in several fats and oils. Strange to say, ordinary resin, or colophony, contains no less than 3·85 per cent. of unsaponifiable matter, whilst resin-oil is credited with nearly 20 per cent. of saponifiable matter.

A delicate test is given for the presence of cotton-seed oil in lard. The unsaponifiable matter obtained from 3 grams of the sample is dissolved in 5 drops of acetic anhydride and 2 drops of sulphuric acid, when the adulteration will be proved by the appearance of a blue coloration changing to green. L. DE K.

Estimation of Alkaloids in White Hellebore. By CH. H LAWALL (*J. pharm.*, 1897, [vi], 6, 362).—Ten grams of white hellebore, 25 grams of chloroform, 75 grams of ether, and 10 grams of 10 per cent. aqueous ammonia are introduced into a dry flask, and the mixture is vigorously shaken, and allowed to remain for 6 hours, or, still better, overnight; 5 c.c. of 10 per cent. aqueous ammonia is then added, the whole well shaken, and 5 c.c. of the clear solution transferred to a separating funnel. The alkaloids are removed by extracting with three portions of acidified water (each 20 c.c.), these extracts being then placed in a separating funnel, rendered alkaline with ammonia, and agitated with a mixture of chloroform (3 vols.) and ether (1 vol.); the extract is run into a tared flask, the solvent distilled off, and the residue weighed. The amount of alkaloids present seems to vary from 1·12 to 1·25 per cent. J. J. S.

Estimation of Hæmoglobin in Cat's Blood. By EMIL ABDERHALDEN (*Zeit. physiol. Chem.*, 1898, **24**, 545—547).—The estimation of hæmoglobin in cat's blood is difficult, because it is hard to obtain crystals of it. To the red corpuscles freed from serum, only an equal volume of water must be added, whereas in the case of dog's blood double, and in the case of horse's blood treble, the quantity must be employed. Crystals can also be obtained by the addition of alcohol in the cold. In estimating cat's hæmoglobin colorimetrically, it was found that solutions which gave the same intensity of colour as solutions of dog's hæmoglobin contained practically the same amount of pigment. W. D. H.

Application of Glan's Spectrophotometer in Animal Chemistry. By AUGUSTIN WRÓBLEWSKI (*Chem. Centr.*, 1897, ii, 532; from *Anzeig. Akad. Wissensch.*, **96**, 386—389; 389—390).—*Estimation of Oxyhæmoglobin in Blood.*—The author has experimented with Glan's apparatus to test the blood of dogs, cats, and human beings. If the amount of hæmoglobin is between 0·06 and 0·2 per cent., the absorption-constant may be taken as 0·0015. On dilution, this figure first becomes less, but, on further diluting, it again slightly increases. The observed region of the spectrum is $\lambda = 554$ to 545. On dilution, the absorption-constant in the region of hæmoglobin falls from $\lambda = 562·5$ to 554, but it gets higher in the region of oxyhæmoglobin. The author found that the amount of oxyhæmoglobin is much increased after a night's rest. The proportion of hæmoglobin in a pregnant dog gradually sunk from 12·88 to 6·21 per cent., but the blood of the pups contained 14·22 per cent.

Estimation of Thiocyanates in Saliva.—The author uses a solution of ferric chloride in hydrochloric acid of 1·4 per cent. strength, when the absorption-constant equals 0·00001022. L. DE K.

Detection of Urobilin and Biliary Pigments. By E. LÉPINOIS (*J. pharm.*, 1897, [vi], **6**, 389—390).—A given quantity of zinc chloride and then dilute ammonia, in amount insufficient to redissolve the precipitated zinc hydroxide, are added to the urine. After filtration, the biliary pigments, together with the zinc hydroxide, remain on the paper, whilst the urobilin, if present, is in the alkaline filtrate, which then exhibits a fluorescence and shows the characteristic spectrum. The precipitate is dissolved in acetic acid, and the pigments tested for by Gmelin's method. J. J. S.

The Precipitation of Proteids. By N. C. Henrik Schjerning (*Zeit. anal. Chem.*, 1898, **37**, 73—87; see this vol., ii, 271).—In consequence of the apparent identity of the proteids precipitated by zinc sulphate or by magnesium sulphate, the author has compared the behaviour of his four typical precipitants, stannous chloride, lead acetate, ferric acetate, and uranium acetate, with that of similar salts of related metals. The results show that, under identical conditions, practically equal amounts of nitrogenous matter are precipitated by each member of a group. Thus, lead chloride and stannous chloride, manganic acetate and ferric acetate, precipitate respectively almost exactly equal quantities of nitrogen. On the other hand, metals whose position in the periodic arrangement shows them to be unrelated, as, for instance, magnesium, copper, and ferrous iron used as sulphates, lead, copper, and mercuric chlorides, the same metals and those of the alkaline earths used as acetates, precipitate widely different amounts of nitrogen. The precipitation of the albumins and albumoses by saturating the solution with a sulphate (Mg,Zn) is of a different character, resulting from no chemical reaction, but being simply due to the sequestration of the proteid-solvent by the salt. It is effected by all easily soluble sulphates, including that of sodium. The results tend to confirm the supposition that the substances which exhibit different behaviour with the four typical reagents are really distinct and definite chemical individuals. M. J. S.

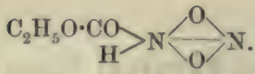
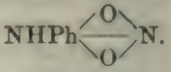
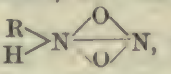
Analysis of Gastric Juice. By L. Cordier (*Compt. rend.*, 1898, **126**, 353—356).—The method adopted by the author is based on the fact that lithium chloride is readily soluble in a mixture of equal volumes of absolute alcohol and dry ether, whilst sodium chloride is insoluble. Five c.c. of gastric juice is mixed with a saturated solution of lithium carbonate until alkaline to litmus, evaporated to dryness at 100°, and heated to dull redness with continual stirring, but avoiding unnecessary rise of temperature. The object is to obtain a colourless, or practically colourless, solution. After cooling, the residue is treated with successive quantities of a mixture of equal volumes of alcohol and ether, about 60 c.c. being necessary to completely dissolve the lithium chloride. The solution contains the chlorine of the free hydrochloric acid and of the combined chlorides, which is estimated in the usual way. The carbonaceous residue is extracted with water containing a small quantity of nitric acid, and the chlorine in this solution is estimated. The sum of the two quantities is, of course, the total chlorine.

Free hydrochloric acid is estimated by means of N/10 sodium hydroxide solution, with the phloroglucol-vanillin reagent as indicator.

This method, when applied to gastric juice of various types, gives results very similar to those obtained with the older method of Hayem and Winter. It is rapid in execution, and requires only a small quantity of material. C. H. B.

General and Physical Chemistry.

Action of Light. I. Physical Changes induced by Light. By Max Roloff (*Zeit. physikal. Chem.*, 1898, **26**, 337—361).—The physical changes caused by light may be divided into changes in the relative position of (1) the atoms, (2) the molecules. Examples of the first class are collected, and show that the general nature of the change is from a maleinoid to a fumaroid form, the original compound possessing in all cases the greater solubility and lower boiling and melting points. The second class of changes are those of polymerisation, in which, however, the actual formation of double or multiple molecules is not necessary, but only a greater volume concentration of molecules. In all these cases, and a large number of examples are adduced, the polymeride is distinguished from the monomeride by (1) smaller vapour pressure, (2) higher melting and boiling points, (3) smaller solubility, (4) lower specific heat; its formation is always exothermic, and by increase of temperature it is again converted to the monomeride. In changes induced in organic compounds it is noticeable that the change is always associated with a double or treble linking, and the author considers that the action of light cannot be regarded as a mere mechanical disturbance of the molecule, but that the explanation must be sought in the influence of electromagnetic waves on axes of electrical polarity of the molecules. Luminescence is frequently associated with the polymerisation and the reverse change, and both phosphorescence and fluorescence appear to be due to the formation of polymerides which are reconverted to the monomerides with luminescence. The crystal colorations are probably due to similar causes, and in the case of sodium and potassium chloride are connected with the production of trivalent chloride. In many cases, the phenomena occur best in the presence of small quantities of impurities, and the author considers the effect of the latter to be that of a 'sensitiser,' but full consideration is postponed. L. M. J.

Spectrochemistry of Nitrogen. VII. By Julius W. Brühl (*Zeit. physikal. Chem.*, 1898, **26**, 47—76. Compare this vol., ii, 362).—A further discussion of the bearing of the author's spectrometric observations on the constitution of various nitrogen compounds which had been examined in solution. *Nitrosobenzene* has the constitution $C_6H_5{\cdot}N{:}O$ in benzene solutions, but in alcoholic solutions it is probable that association occurs. *Tetramethylethylenenitrosyl chloride* does not contain the $\cdot N{:}O$ group, and has probably a ring constitution for which the author proposes two forms. In the case of *phenylhydroxylamine*, the results are doubtful, but indicate a constitution analogous to that of hydroxylamine itself, that is, $NHPh{\cdot}OH$, in preference to $NH_2Ph{:}O$. *Paranitrodiazobenzene methylic ether* (Abstr., 1894, i, 282) belongs to the series of isodiazotates, and has the constitution $NO_2{\cdot}C_6H_4{\cdot}N{:}N{\cdot}OMe$. *Nitrourethane*, partly on physical but partly on chemical grounds, is considered to be  $\substack{C_2H_5O\cdot CO\\ H}{>}N{<}\substack{O\\ O}{>}N$. From the examination of *benzenediazoic acid* and its substitution derivatives, the value of the N_2O_2 group is found to be slightly greater than in the aliphatic nitramines, and the increase is ascribed to the influence of the solvent and of the phenyl group. The constitution proposed by Hantzsch (Abstr., 1894, i, 456) would yield much lower values, and the acid hence possesses the nitramine constitution, that is,  $NHPh{<}\substack{O\\ O}{>}N$. Derivatives of primary and secondary *nitramines* and *isonitramines* showed that in each class the spectrometric values of the group N_2O_2 were identical, and the author considers as probable the following formula,  $\substack{R\\ H}{>}N{<}\substack{O\\ O}{>}N$, primary nitramines; OH·NR·N:O isonitramines, and the differences in the two series of isonitramine derivatives are to be ascribed to differences in the configuration with respect to the nitrogen atom. L. M. J.

Influence of X-Rays on the Luminosity of Gases. By Alexander de Hemptinne (*Zeit. physikal. Chem.*, 1898, 26, 165—169).—When a tube containing gas, at low pressure, is exposed to electrical oscillations, it becomes luminous when the pressure is reduced sufficiently, but if exposed also to the influence of X-rays the pressure at which luminosity occurs is increased. This effect of the rays was examined quantitatively, and the subjoined table gives the pressure at which the gas becomes luminous (I) by the oscillations alone, (II) by the simultaneous action of X-rays; (III) gives the percentage increase of pressure.

	Molecular wt.	I.	II.	III.
Hydrogen	2	71 mm.	94 mm.	32·4
Oxygen	32	51 ,,	68 ,,	33·3
Methylic alcohol	32	17·5 ,,	27·5 ,,	57·1
Ethylic alcohol	46	16·5 ,,	26 ,,	57·5
Ethylic ether	74	14 ,,	24 ,,	64·3
Chloroform	119	10 ,,	18 ,,	80

The influence of the X-rays increases with the molecular weight and molecular complexity of the gas. The author does not consider the effect to be due to decomposition into atoms, or ions, and advances, with reserve, the hypothesis that a certain mobility is imparted to the ether by the rays, and this causes acceleration of the intramolecular oscillations, and hence, under the influence of the electrical oscillations, causes dissociation of some molecules, and brings about a multitude of minute discharges from molecule to molecule. As the luminous gas in a vacuum tube has conducting properties, the author considers it possible that it also, like metals, would absorb the X-rays, but experiments show that this was not the case, the luminous tube being as transparent in this respect as a non-luminous tube. L. M. J.

Validity of Maxwell's Equations. By ANTON SCHEYE (*Zeit. physikal. Chem.*, 1898, **26**, 159—160).—The author upholds the validity of Maxwell's equations, and points out two sources of error in Wedell-Wedellsborg's paper on this subject (this vol., ii, 61); of these the more important is that in the equations expressing the conservation of energy during the induction phenomena, the energy of the electric current was entirely neglected. L. M. J.

Oxidation and Reduction Chains, and the Influence of Complex Ions on the Electromotive Force. By RUDOLF PETERS (*Zeit. physikal. Chem.*, 1898, **26**, 193—236).—If a mercury electrode be employed in a mixture of ferrous and ferric salts, a reaction proceeds in accordance with the equation $Hg + Fe^{\cdot\cdot\cdot} + Cl' = Fe^{\cdot\cdot} + HgCl$. For any concentration the potential is given by the expression $\pi = RT/F \times \log. C_2c_3/C_3c_2$, where C_2/C_3 is the equilibrium ratio of the ferrous to ferric ions, and c_2, c_3 the actual concentration of these ions; this may be written $\pi = A + 0{\cdot}0575 \log. c_3/c_2$, and the value of A may be obtained directly by making $c_3 = c_2$ or by calculation from the E. M. F. at any concentration, and the values so obtained from the E. M. F. of a number of very different mixtures agreed very closely and corresponded with an equilibrium ratio $k = 10^{A/0{\cdot}0575} = 10^{7{\cdot}50}$, which is hence the ratio of the numbers of ferrous and ferric ions when the solution is in equilibrium with the normal electrode. (Complete or equal dissociation of the two ion salts is assumed in the calculation.) By the addition of potassium chloride, the value of k was diminished, the mean value obtained being $10^{7{\cdot}15}$. In neutral solutions, the potential was found to vary considerably with dilution, but this was not the case in acid solutions or solutions containing potassium chloride. Solutions in a normal sodium nitrate solution gave values almost identical with those in pure water, so that ferric chloride and ferric nitrate are equally dissociated. In the case of mixtures of ferric and ferrous sulphates, the value of k was found to be $10^{6{\cdot}6}$, so that at equal concentrations ferric sulphate gives fewer ferric ions than the chloride. Experiments with chromous and chromic compounds, and with manganous and manganic compounds, gave no quantitative results, as constant values could not be obtained. The van't Hoff expression employed for the ion chain was, however, found to be at least qualitatively correct. Addition of fluorine ions in all cases raises the reduction potential, and this effect was further examined. The conductivity of mixtures of iron salts with sodium fluoride is less than the sum of the conductivities of the constituents, the difference being greatest with ferric compounds, in which case also it increases with dilution. The ferric salts, therefore, probably form complex compounds with the sodium fluoride, a view further supported by freezing point determinations. By the addition of sodium fluoride to the mixed ion salts

the E. M. F. falls greatly; thus, in the case of a mixture of N/10 ferrous and ferric salts the addition of an equal volume of 3N/10 solution of sodium fluoride caused the E. M. F. to become negative, or decreased the concentration of the ferric ions to $10^{-7\cdot5}$ of its former amount. A white salt is also precipitated by the fluoride, and the composition was found to be $Na_3FeF_6 + \frac{1}{2}H_2O$. This was proved to be a complex salt in which the iron is present in the anion, as by electrolysis the percentage of iron increased at the anode and decreased at the cathode. It is probable that the reduction of the E. M. F. by addition of sodium fluoride is due to the formation, not only of the slightly dissociated ferric fluoride, but also of this salt.
L. M. J.

Chemical Equilibrium and Electromotive Force. By CARL KNÜPFFER (*Zeit. physikal. Chem.*, 1898, **26**, 255—284).—In the galvanic chain, thallium in thallium chloride | potassium chloride | potassium thiocyanate | thallium in thallium thiocyanate | the reaction may be represented by $TlCl + SCN' = Cl' + TlSCN$, and if the ratio of the equilibrium concentrations of chlorine and thiocyanate ions $= k$ and the ratio of these ions actually present $= a$, then the electromotive force is given by the expression $\pi = RT/F. \log. k/a$. From determinations of the E. M. F., therefore, the ratio of the equilibrium concentrations may be calculated. The values so obtained were compared with those obtained chemically, the numbers being

Temperature.	Electrically found ratios.		Chemically found ratio.
39·9°	0·87	0·88	0·85
20·0	1·27	1·25	1·24
0·8	1·77	1·82	1·74

The above reaction is attended with the heat development of $+ 31\cdot8K$ and from this the temperature coefficient of the equilibrium constant may be deduced by the expression $\log. K_2 - \log. K_1 = q/R(1T_1 - 1T_2)$ and the temperature coefficient of the E. M. F. by the expression $(\pi - q)T' = d\pi/dT'$. The values $K_{20}/K_{39\cdot9}$ and $K_{0\cdot8}/K_{39\cdot9}$ so obtained agree well with the chemically found values, and the temperature at which $K = 1$ is found to be (1) 31·2°, (2) 32·5°, whilst the temperature at which the change in direction of the current occurs agrees well with the found temperature in each of the galvanic chains examined.
L. M. J.

Quinones and Quinols. By AMAND VALEUR (*Compt. rend.*, 1897, **125**, 872—874).—The following thermochemical data have been obtained for various quinones and quinols.

	Melting point.	Heat of combustion at constant volume.	Heat of combustion at constant pressure.	Heat of formation.
Benzoquinone			656·8 Cal.	+47 Cal.
Toluquinone	68°	805·05 Cal.	805·3 „	+61·8 „
Thymoquinone......	45	1273·4 „	1274·6 „	+82·4 „
Quinol			685·4 „	+87·3 „
Toluquinol	126	836·3 „	836·9 „	+99·2 „
Thymoquinol	139	1308·1 „	1308·6 „	+117·4 „

The difference between the heats of formation of toluquinone and benzoquinone (14·8 Cal.) is much greater than that between the heats of formation of toluene and benzene (namely 6·4 Cal.). The difference between a quinone and the corresponding phenol, with the exception of the first members of the two series, appears to be about 6 Cal.; for example, thymol = 76 Cal., thymoquinone = 82·4 Cal.

Benzoquinone $+ H_2 =$ quinol $+ 40·3$ Cal.
Toluquinone $+ H_2 =$ toluquinol $+ 37·4$ „
Thymoquinone $+ H_2 =$ thymoquinol $+ 35·0$ „

J. J. S.

Behaviour of Atmospheric Air and of Chemically Prepared Gases at about 350—500° under Atmospheric Pressure. By H. Teudt (*Zeit. physikal. Chem.*, 1898, **26**, 113—131).—The author describes the air thermometer at constant pressure which was used in the experiments, and investigates the probable sources and extent of the experimental errors. Temperatures were taken by a Jena glass thermometer, graduated to 550° and having the upper space filled with nitrogen. Atmospheric air from the laboratory and from the open showed in all cases a very marked increase of expansion at temperatures above 350°, the difference between the observed and calculated volumes reaching about 2 per cent. at 400° and 3 per cent. at 450°. Similar results were obtained with air which had been freed from oxygen and carbonic anhydride. Chemically prepared oxygen and nitrogen, however, gave results in almost complete accord with Gay Lussac's law. The differences found with the air cannot be due to moisture, as the other gases were also moist, and it is very improbable that they could be occasioned by the small quantity of argon which is present. To explain the results, it is necessary for about 8 per cent. of the air to be dissociable into 2 atoms or 6 per cent dissociable into 3 atoms. Air collected immediately after rain did not show the effect, so it appeared probable that the dissociable portion is more soluble in water, and the author therefore attempted to concentrate it by collecting the gases dissolved in water. A greater divergence from Gay Lussac's law was thus obtained, and a similarly more concentrated product appeared to be obtained by diffusion. The author considers that these results indicate a probable allotropic modification of nitrogen, the existence of which is also probable from the relationship of that element to phosphorus. L. M. J.

Vapour Pressure of Homogeneous Mixtures. By F. Dolezalek (*Zeit. physikal. Chem.*, 1898, **26**, 321—336).—The work necessary to transport 1 gram equivalent from a dilute to a concentrated solution may be also determined from that necessary to distil the solvent in the reverse direction and an expression may be thus obtained for the E. M. F. of a concentration chain. By equating the two values of the E. M. F. thus obtained, the equation $n_2 \log.\, p_2 - n_1 \log.\, p_1 - \int_{n_1}^{n_2} \log.\, pdn = \log.\, \pi_2/\pi_1$ is obtained which reduces to $\pi_2/\pi_1 = p_2^{n_2}/p_1^{n_1} \; e - \int_{n_1}^{n_2} \log.\, pdn$ where

p_1, p_1 are the partial pressures of the solvent, n_2, n_1 the number of molecules of solvent for 1 molecule of solute, and π_2, π_1 the partial pressures of the solute. If electrodes reversible with respect to the solvent be employed, a corresponding expression for p_2/p_1 is obtained. Hence the partial pressure curve of the solute may be obtained from that of the solvent, and *vice versâ*. The author describes fully the apparatus and method employed for the determination of the partial pressures and the E. M. F., and the values obtained for the latter are compared with those calculated as indicated, the agreement being very satisfactory. The relative pressures of sulphuric acid and water in various mixtures was determined, and it was found that the ratio sinks very rapidly on dilution, being 1 at 58·4 per cent. and 2×10^{-4} at 35·8 per cent. The author further deduces from the above equations the simple relation $d \log. \pi / d \log. p = n$. L. M. J.

Demonstration of the Ludwig Phenomenon. By RICHARD ABEGG (*Zeit. physikal. Chem.*, 1898, **26**, 160—164).—The Ludwig phenomenon is the term applied to the diffusion of a dissolved substance from places of higher to places of lower temperature in a solution, an effect ascribed by Van't Hoff to the greater osmotic pressure at higher temperatures. This phenomenon may be demonstrated by enclosing a vessel containing the solution in a glass mantle, through the lower portion of which cold water circulates while the upper part is heated by a current of steam. If the solution is saturated for the lower temperature, then as the solute diffuses from the hotter portions, crystals form and grow in the cold liquid, and this may be well observed in a couple of hours with sodium chloride, potassium iodide, copper sulphate, and other salts. No quantitative measurements were made, but it is doubtful whether Van't Hoff's explanation is sufficient, and the author suggests that the hot and cold water may also partially act as different physical liquids. L. M. J.

Non-electrolytic Dissociation of Water in Aqueous Ethylic Alcohol. By ROBERT LUTHER (*Zeit. physikal. Chem.*, 1898, **26**, 317—320).—The dissociation constants of water in two solvents are given by the equations $K_A(H_2O)_A{}^2 = (H_A)^2O$, and $K_B(H_2O)_B{}^2 = (H_B)^2O_B$, where the symbols represent the active masses of the constituents in solvents A and B. The ratios of the active masses of the gases are given by their solubilities in the two solvents, and that of the active masses of water by its partial vapour pressure in the two liquids, and hence the ratio K_A/K_B can be obtained. The author calculates this ratio for various mixtures of ethylic alcohol and water, and finds that it at first decreases until the percentage of alcohol reaches about 25 per cent., when it increases very rapidly. The concentration of hydrogen and oxygen in water vapour at 20° is calculated as 10×10^{-27} and 5×10^{-27} molecules per litre respectively. L. M. J.

Solubility of Iodine in Mixed Solvents. By LUDWIK BRUNER (*Zeit. physikal. Chem.*, 1898, **26**, 145—151).—The solubility of various compounds in water is lowered by the addition of alcohol, and the hypothesis is largely accepted that the alcohol abstracts some of the water with the formation of hydrates. Bodländer found this hypothesis was not supported by facts, and that when the solid was insoluble in one of the solvents the expression $W \sqrt[3]{S} =$ constant represents the solubility, where $w =$ percentage of water, and s that of the salt. The author has therefore investigated the less complicated case of the solubility of iodine in mixtures of solvents, the values obtained being compared with those calculated by the mixture rule. Mixtures of benzene, carbon bisulphide, chloroform, carbon tetrachloride, ethylic alcohol, and normal propylic alcohol were investigated, and diagrams are given showing the results obtained. With the sole exception of the mixture of 90 per cent. benzene with 10 per cent. chloroform, the values are lower than those calculated, and the greatest differences are obtained in the case of alcoholic mixtures. The previously observed case of aqueous alcohol is therefore probably but an example of a general law. If a dilute solution of potassium iodide be regarded as a mixture of a concentrated solution with water, it follows that the solubility of iodine in this solvent should increase more rapidly than the percentage of potassium iodide and this is found to be the case, the ratio I/KI being a function of the potassium iodide concentration. L. M. J.

Proof of the Theory of the Solubility of Salts consisting of Three Ions. By Arthur A. Noyes and E. Harold Woodworth (*Zeit. physikal. Chem.*, 1898, **26**, 152—158).—In the case of salts consisting of two ions, the influence of an admixed salt with one similar ion on the solubility has been proved to be in accord with the theory $k_1 \times k_2 =$ constant, where k_1 and k_2 are the concentrations of the two ions. In the case of salts of three ions, a complete proof of the expression $k_1 \times k_2 =$ constant has not been obtained, and the author therefore attempted to verify this equation by the determination of the solubility of lead iodide in water and in very dilute solutions of potassium iodide and of lead nitrate. Owing to the extreme dilution, the salts are almost completely dissociated, so that dissociation changes do not occur to complicate the results. The solubility determinations were done by the conductivity method, which has the advantage of giving directly the number of ions. If m_0, a_0 are the solubility and dissociation of lead iodide in water and m_1a_1, m_2a_2 the corresponding values for the lead iodide and potassium iodide in the mixed solution, then $m_1a_1 \ (m_1a_1 + m_2a_2)^2 = m_0^3a_0^3$ and as m_2a_2 and m_0a_0 are known, the values for m_1a_1 are obtained by approximations. For the lead nitrate solutions the expression $(m_1a_1 + m_2a_2) \ m_1^2a_1^2 = m_0^3a_0^3$ holds, and the values for m_1a_1 in this case may be similarly obtained. The calculated values agree very closely with the determinations, so that for lead iodide the solubility law stated is valid. L. M. J.

The Hydrolysis of the Ethereal Salts of Dibasic Acids. By Osc. Knoblauch (*Zeit. physikal. Chem.*, 1898, **26**, 96—108).—The hydrolysis of the ethereal salts of a dibasic acid must not be regarded as a reaction of the second order, but as taking place in two stages, (1) the hydrolysis to the acid ethereal salt, (2) the further hydrolysis of this to the acid, and the composition at any time will, therefore, be a function of two velocity constants, not of one only. The theoretical investigation of this subject has been worked out by Ostwald (*Lehrbuch der Allg. Chem.*, 2, part ii, 277), and in order to verify the equations there obtained the author has investigated the hydrolysis of ethylic succinate by sodium hydroxide. If C_1, C_2, C_3, and C_4 represent the concentration of alkali, ethereal salt, acid salt, and sodium succinate respectively, then $dC_1/dt = -k_{1\cdot2}C_1C_2 - k_{1\cdot3}C_1C_3$, and as in the initial stages C_3, and the final stages C_4, is negligeable, it follows that observations at the commencement and end of the hydrolysis give the values for $k_{1\cdot2}$ and $k_{1\cdot3}$ respectively. The values so obtained are almost constant, and from them the composition at intermediate stages is calculated and found to agree well with the observations, so that Ostwald's equations for the two-stage hydrolysis may be regarded as experimentally verified. L. M. J.

Equilibrium in the System—Water, Benzoic Acid, and Ethylenic Cyanide. By FRANS A. H. SCHREINEMAKERS (*Zeit. physikal. Chem.*, 1898, 26, 237—254).—The above system differs from others previously examined in the fact that of the three pairs of liquids, only one, benzoic acid and ethylenic cyanide, forms a homogeneous mixture, whilst the other two pairs form two liquid layers only within definite temperature limits, namely, 18·5—56·5° for water and ethylenic cyanide, and 95—115·5° for water and benzoic acid. The equilibrium curve for the last pair has been determined by Alexéeff, and may be divided into three parts: (1) liquid 1 + solid acid; (2) liquid 1 + liquid 2; (3) liquid 2 + solid acid; the critical temperature for the two liquid phases is 115·5°. The equilibrium curve for water and cyanide was previously determined by the author (Abstr., 1897, ii, 483), and the remaining curve for benzoic acid and the cyanide was therefore determined, and the composition of the liquid in equilibrium with each solid phase is given. In the case of the equilibrium of the three compounds, the cryohydric point for ice-cyanide-acid liquid is a little below −1·2°, and here three equilibrium curves meet, of which two are ice curves, the third being that of cyanide-acid-liquid, and the composition of the liquid phase at different temperatures is determined. On this curve the quintuple point for cyanide-acid-liquid 1 and liquid 2 occurs at 11—12°, and the composition of the two liquid phases was determined. Representing the more aqueous phase by liq. 1, increase of temperature causes the change $\text{liq.}_1 + \text{cyanide} + \text{acid} \rightarrow \text{liq.}_2$, and at the quintuple point four curves meet, of which one, namely, that for $\text{acid} + \text{liq.}_1 + \text{liq.}_2$ is interesting inasmuch as the equilibrium occurs from 11·5° to 51° and again from 87° to 96°, but not in the interval 51—87°, as at the lower of these two temperatures the composition of the two liquid phases becomes identical. From the equilibrium curves with a solid benzoic acid phase, it is seen that the solubility in certain mixtures of cyanide and water is greater than in either constituent. The other equilibrium curves are traced, and the necessary diagrams are given in the paper.

L. M. J.

Velocity of Crystallisation. By GUSTAV TAMMANN (*Zeit. physikal. Chem.*, 1898, 26, 307—316).—The author describes the differences in the structure and habit of the crystals produced with various degrees of undercooling, and hence various velocities of crystallisation. At first clear crystals form irregularly, then at those temperatures where the velocity increases with the undercooling, the crystals form parallel to the long axis of the tube and enclose noticeable liquid spaces, but when the velocity of crystallisation is constant the crystallisation is complete, and only air spaces occur due to contraction. The effect of pressure is to diminish the crystallisation velocity, the constant for benzophenone being decreased in the ratio 1 : 0·96 by a pressure of 300 atmospheres. The author calculates the temperature at which the heat evolved by crystallisation is sufficient to raise the whole mass to the melting point by the equation $T = T_0 - r_0/c_m$ where r_0 is the latent heat of crystallisation, c_m the mean specific heat of the liquid between T and T_0, and T_0 the melting point. Thus, calculated for betol, $T = 45°$, and this should be the temperature at which the crystallisation velocity begins to decrease; the temperature experimentally found was 58°, and this higher value is explained by the fact that the change is not actually adiabatic. The composition of the limiting layer can be calculated by the expression $x = C_m t/r_0$ where t is the undercooling and x the percentage of crystals, the assumption being made that the whole of the limiting layer is brought to the melting point. The variation of the velocity of crystallisation is explained by an assumed influence of the crystals on the liquid, this influence increasing with undercooling until a constant value is reached. The author finally replies to some objections raised by Küster (this vol., ii, 330) against the assumption that the melting point temperature always prevails in the limiting layer of crystallisation. L. M. J.

Inorganic Chemistry.

Simple Method for the Preparation of Diazoimide. By MAXIMILIANO DENNSTEDT and WILHELM GÖHLICH (*Chem. Zeit.*, 1897, 21, 876—877).—When a dilute solution of diazoimide is oxidised, in an atmosphere of carbonic anhydride, with potassium permanganate and sulphuric acid, the only gaseous product is nitrogen.

The best method of obtaining diazoimide from hydrazine is to treat the sulphate, N_2H_4,H_2SO_4, with nitrous acid. A much better yield, namely, 0·2 gram from 5 grams of the sulphate, is obtained by this method than by that recommended by Curtius (Abstr., 1893, ii, 372). Potassium nitrite (3·3 grams) is dissolved in water (about 200 c.c.), and sufficient sulphuric acid is added to neutralise the free alkali present and also to liberate the nitrous acid; this solution, which is well cooled, is added to a well-cooled aqueous solution of hydrazine sulphate (5 grams), and after the evolution of gas has ceased the mixture is distilled, when a dilute solution of diazoimide passes over. The gases evolved consist of oxygen, nitrogen, and nitrous oxide.

J. J. S.

Salts of Hydrogen Nitride. By LOUIS M. DENNIS and C. H. BENEDICT (*Zeit. anorg. Chem.*, 1898, 17, 18—25).—*Lithium nitride*, $LiN_3 + H_2O$, prepared by neutralising a solution of lithium hydroxide with hydrogen nitride and allowing the solution to evaporate in the air, crystallises in colourless, lustrous needles, is hygroscopic, and very easily soluble in water or alcohol. When gently heated, it loses its water of crystallisation, and on further heating is decomposed.

Sodium nitride, NaN_3, prepared in the same way as the lithium salt, separates in clear, colourless crystals. The freshly prepared aqueous solution is neutral, but becomes alkaline after some time. It is not easily decomposed by heat, and can be maintained molten for several hours without undergoing decomposition.

Potassium nitride, KN_3.—The freshly prepared solution rapidly becomes alkaline; the crystalline salt is obtained by allowing the solution to evaporate by exposure to air, and adding a few drops of hydrogen nitride from time to time so as to maintain a slightly acid reaction. It melts when heated, is decomposed only at a high temperature, and is sparingly soluble in alcohol, so that it can be precipitated from the aqueous solution by the addition of alcohol.

Rubidium nitride, RbN_3, crystallises in slender needles, is extremely soluble in water, from which solvent it is precipitated by the addition of alcohol, melts when gently heated and decomposes at a higher temperature with an explosion and evolution of light.

Cæsium nitride, CsN_3, obtained by allowing the solution to evaporate over sulphuric acid, crystallises in colourless needles, is extremely soluble in water, insoluble in alcohol, and decomposes only when heated to a high temperature.

All the alkaline nitrides are stable on exposure to air except the lithium salt, which gradually decomposes. None of the salts are explosive, and the tendency to decompose by heat decreases with increase of the atomic weight of the base. They resemble the chlorides of the alkalis in their solubility in water, and the solubility increases with the atomic weight of the base; the solubility in alcohol varies in the reverse direction to that in water.

Calcium nitride, CaN_6, prepared by dissolving calcium oxide in a dilute solution of hydrogen nitride and then evaporating over sulphuric acid, crystallises in white aggregates, decomposes when heated in solution on the water bath, and when heated alone explodes somewhat violently. *Strontium nitride*, SrN_6, resembles the calcium salt. *Barium nitride*, $BaN_6 + H_2O$, forms lustrous crystals, and decomposes with a loud explosion when heated. The nitrides of the alkaline earths are all soluble in water, the solubility decreasing with increase in the atomic weight of the base. When exposed to the air they become alkaline, and in aqueous solution gradually evolve hydrogen nitride. The crystallographic examination of the salts shows that the lithium and sodium salts crystallise in the hexagonal system, the potassium, rubidium, and cæsium salts in the tetragonal system, the calcium and strontium salts in the orthorhombic, and the barium salt in the triclinic system. E. C. R.

Catalytic Influence of various Gases and Vapours on the Oxidation of Phosphorus. By M. CENTNERSZWER (*Zeit. physikal. Chem.*, 1898, 26, 1—46).—The luminosity and oxidation of phosphorus in air or oxygen only occurs when the pressure is reduced to a quantity which is a function of the temperature, and is also affected by the presence of other gases. According to Joubert's results, the luminosity pressure of oxygen is a linear function of the temperature, two sets of experiments having given the results. (1) $P = 270 + 19{\cdot}57t$, (2) $P = 320 + 23{\cdot}19t$, whilst, further, the partial pressure of oxygen is a linear function of the percentage volume concentration of the admixed gas, being given by the equation $p_x = p_0 - Ax$; all gases hence reduce the necessary oxygen pressure, but to different extents, the magnitude of the constant A differing for the various gases. The author has further studied this effect, employing a large number of gases and vapours at various concentrations, and a full description of the experimental methods is given. An intermittent luminosity was observed when the pressure is a few centimetres above that necessary for continuous luminosity, but this phenomenon was not further investigated. The author finds that the simple formula of Joubert does not hold except for small concentrations, and a quadratic expression $p_x = p_0 - Ax + Bx^2$ is necessary, and the constants A and B are given for all the compounds examined. The agreement between the observed values and those calculated by this formula is, however, far from satisfactory, and the author considers a logarithmic expression would give better results. The value of the constant A appears to increase with the number of carbon atoms and also with double linking. Substituents appear to produce little effect, except iodine, which causes an enormous increase in the constant. The presence of small quantities of ozone increases the luminosity pressure of the oxygen, and the author considers this to be the probable cause of the higher values for the pressure which were obtained by Ewan (Abstr., 1895, ii, 213) and Joubert. The discussion of the nature of the process is postponed.

L. M. J.

Perborates and their Constitution. By SIMEON M. TANATAR (*Zeit. physikal. Chem.*, 1898, 26, 132—134).—The salts of persulphuric and analogous acids are by some chemists regarded as compounds of metallic peroxides with peroxides of negative elements and not analogous to ordinary salts. The heat of decomposition by sulphuric acid was determined in the case of sodium perborate and ammonium perborate, the values obtained being respectively $+2{\cdot}614$ Cal. and $+3{\cdot}475$ Cal., which indicate a constitution similar to other salts and not a combination of peroxides for which much higher values should be obtained. These salts, which possess powerful oxidising properties, may be produced by the electrolysis of the orthoborate or by its oxidation by means of hydrogen peroxide. L. M. J.

The Hydrate formed by Potassium Carbonate, and its Dissociation. By HENRI LESCŒUR (*Bull. Soc. Chim.*, 1897, [iii], 17, 18—23).—Measurements of the vapour pressures at 20° and 100° of systems containing potassium carbonate and water in various proportions, indicate the existence of a hydrate of the formula $K_2CO_3 + 2H_2O$. Its dissociation pressure is less than 1·5 mm. at 20° and is 100 mm. at 100°; no other hydrate appears to exist. Experiments made on the dehydration of alcohol by potassium carbonate show that this hydrate is the first compound to be formed, the remainder of the water present uniting with the alcohol in the proportions corresponding with the hydrate $4C_2H_6O,H_2O$, whilst any excess dissolves the hydrated potassium carbonate and forms a solution in which the alcohol is insoluble. The discordant results which the author and other observers have previously obtained in researches on the hydrate of potassium carbonate are attributed to neglect of the influence of carbonic anhydride. Old specimens of the salt which have been exposed to the air may contain 50 per cent. of the hydrogen potassium carbonate. N. L.

Silver Plumbite. By FRIEDRICH BULLNHEIMER (*Ber.*, 1898, 31, 1287—1289).—A compound, $Pb(OAg)_2$, has been obtained by adding excess of a solution of lead nitrate in aqueous potash to a solution of silver nitrate in aqueous potash, with just so much ammonia that no precipitate forms at once when this solution is mixed with the lead solution, about 2 grams of lead nitrate being added for every gram of silver nitrate. The mixture is warmed gently in the water bath, when a crust of small needles with the above composition is deposited. Silver plumbite is brown, and has a black streak; it is stable towards dilute acids and alkalis, but is decomposed by strong acids.

C. F. B.

Double Thiosulphates of Copper and Sodium. By CHANDRABHUSHAN BHADURI and IYOTIBHUSHAN BHADURI (*Zeit. anorg. Chem.*, 1898, 17, 1—17).—When solutions of sodium thiosulphate and copper sulphate are mixed and allowed to remain for some time, coloured salts are obtained. The colour of these salts depends on the ratio of the sodium thiosulphate to the copper sulphate, the concentration of the solutions, and the presence of alcohol.

A *yellow* salt is obtained by mixing saturated solutions of copper sulphate (1 mol.) and sodium thiosulphate (2 mols.) at 20° to 34°, which the authors consider to be a double thiosulphate of the formula $7Cu_2S_2O_3,5Na_2S_2O_3 + 16H_2O$.

A *salt* which has approximately the composition $4Cu_2S_2O_3,3Na_2S_2O_3 + 9H_2O$, but which varies slightly according to the temperature at which it is prepared, is obtained by mixing saturated solutions of copper sulphate and sodium thiosulphate previously heated to 50—60°.

The above yellow salt is also obtained by mixing solutions of copper acetate and sodium thiosulphate in almost any proportion. The reddish precipitate of cuprous hydroxide, which is obtained by the action of sodium hydroxide on the yellow salt, is partially converted into copper sulphide when the mixture is heated to boiling; this is due to the reaction between the cuprous oxide and sodium thiosulphate. The authors find that cuprous oxide dissolves in sodium thiosulphate when gently warmed according to the equation $Cu_2O + H_2O + Na_2S_2O_3 = 2NaOH + Cu_2S_2O_3$. The copper thiosulphate is held in solution by an excess of sodium thiosulphate. Under ordinary conditions, this solution is very unstable, and quickly deposits copper sulphide.

A *white* salt, $9Cu_2S_2O_3,5Na_2S_2O_3,8NaCl + 12H_2O$, is obtained by adding a concentrated solution of sodium thiosulphate to a solution of copper chloride. It is also obtained in an impure state by dissolving the yellow salt in dilute hydrochloric acid, and precipitating with concentrated acid.

The *salt*, $Cu_2S_2O_3,Na_2S_2O_3 + 2\frac{1}{2}H_2O$, is obtained as a yellowish-white precipitate by mixing a concentrated solution of copper sulphate or acetate (1 mol.) with a solution of sodium thiosulphate (2 mols.), and after allowing the mixture to remain for some time adding a large excess of acetic acid; it is very stable when dry, even if exposed to the air. E. C. R.

Action of an Alkaline Solution of Stannous Chloride on Lead Salts. By LUDWIG VANINO and F. TREUBERT (*Ber.*, 1898, **31**, 1118—1119).—When a solution of lead nitrate is treated with stannous chloride and a large excess of 10 per cent. aqueous soda, the precipitate, after it has been freed from tin by washing with cold 5 per cent. sulphuric acid, consists of metallic lead. C. F. B.

Double Iodide of Lead and Potassium. By FREDERICK C. HUXLEY BROOKS (*Chem. News*, 1898, **77**, 191).—When a solution of lead nitrate, containing 1 gram in 10 c.c., is treated with a saturated solution of potassium iodide until the precipitate is just dissolved, and the mixture left standing for a few minutes, a copious, crystalline precipitate forms having the composition $PbI_2,2KI$. When washed with absolute alcohol and dried between filter papers, it forms silky, acicular, almost white crystals, slightly soluble in boiling chloroform, readily soluble in strong potassium iodide, insoluble in alcohol; when heated gently, it becomes yellow, but resumes its original shade on cooling; if strongly heated, partial decomposition ensues with the evolution of iodine. The most characteristic reaction is its decomposition into lead iodide and potassium iodide by the action of water, this is so sensitive that the moisture of the air is sufficient to effect it in a few minutes, as indicated by the appearance of a yellow coloration.

D. A. L.

Atomic Weights of Praseodymium and Neodymium. By HARRY C. JONES (*Amer. Chem. J.*, 1898, **20**, 345—358. Compare Brauner, Proc., 1898, 70).—The atomic weight of praseodymium was determined by converting the peroxide into the sesquioxide by reduction in an atmosphere of hydrogen, and then synthesising the sulphate from the latter oxide. Attempts were made to convert the peroxide directly into the sulphate, and to estimate the sulphuric acid in this salt by precipitation with barium chloride, but as the precipitate always contains praseodymium, the method had to be abandoned (compare Marignac, *Ann.Chim.Phys.*,[iii], 1849, **27**, 231; 1853, **38**, 151).

A similar method was used in the case of neodymium, but as the oxide is a sesquioxide, reduction in a current of hydrogen was unnecessary.

The oxides used were prepared from the double nitrate of praseodymium or neodymium and ammonium (purified by fractional crystallisation from concentrated nitric acid) by conversion into the oxalate, and subsequent heating.

As a mean of twelve determinations in each case, the value for praseodymium is 140·46 where O = 16; or 139·41 where O = 15·88; and for neodymium 143·55 where O = 16 or 142·47 where O = 15·88; the difference between the highest and lowest determination in each case being 0·16.

The author compares his results with those obtained by von Welsbach (Abstr., 1885, 1113), and is at a loss to explain that the values appear to be reversed.

	Von Welsbach.	Jones.
Pr.	143·6	140·45.
Nd.	140·8	143·6.

A. W. C.

Note.—This is practically the same result as arrived at by Brauner (*loc. cit.*), who obtained for praseodymium the value 140·95, and for neodymium 143·63. A. W. C.

Cobalt Nitrite and Cobalt Nitrocyanide Compounds. By Arthur Rosenheim and Ivan Koppel (*Zeit. anorg. Chem.*, 1898, 17, 35—72).—Compounds of the constitution $3R_2O,Co_2O_3,6N_2O_3$ are obtained by treating a mixture of the theoretical quantities of cobalt carbonate and the carbonate, oxide, hydroxide, or nitrite of the other metal, in aqueous solution, with a current of nitrous anhydride, prepared from arsenic trioxide and nitric acid, until the cobalt carbonate is completely dissolved. The potassium salt, $3K_2O,Co_2O_3,6N_2O_3$, and the rubidium and cæsium salts are pure, deep yellow. The potassium salt, when boiled with water, dissolves with evolution of nitric acid, and the solution, on evaporation, yields a mixture of red and yellowish-brown crystals, which cannot be separated. The *sodium* salt, with xH_2O, prepared as described above, is precipitated from its aqueous solution by the addition of alcohol, as a microcrystalline, pure yellow powder, and does not contain water of crystallisation. Kahlbaum's "Natriumkobaltidnitrit" consists of this salt crystallising with $5\frac{1}{2}H_2O$. Both salts dissolve easily in water to a deep, yellowish-brown solution, which decomposes when heated. When the aqueous solution is treated with a potassium salt, a characteristic, yellow precipitate of the corresponding potassium salt is at once formed; similar precipitates are obtained with ammonium, barium, and lead salts, but with silver nitrate the characteristic precipitate of silver nitrite is obtained. The *ammonium* salt, with $1\frac{1}{2}H_2O$, crystallises in bright yellow rosettes, is slightly soluble in water, decomposes when the solution is warmed, and is very stable when dry. The *barium* salt, with $14H_2O$, is obtained by treating a mixture of cobalt carbonate and barium nitrite with nitrous acid; a deep brownish-red solution is obtained, which is filtered before all the cobalt carbonate is dissolved, and the filtrate is again treated with nitrous acid; it is a yellow, crystalline powder consisting of microscopic six-sided tablets, is insoluble in water, is not so stable as the alkali salts, and is completely decomposed after remaining a few days. The *lead* salt, with $12H_2O$, obtained as a bright yellow powder by adding lead acetate to a solution of the sodium salt, and as a bright red, crystalline powder by treating a mixture of cobalt carbonate and lead oxide with nitrous acid, is very stable when dry, is insoluble in water, and, when treated with hydrogen sulphide, is completely decomposed.

Salt of the constitution $2R_2O,Co_2O_3,4N_2O_3$.—The *sodium* salt is obtained by allowing the brown mother liquors obtained in the preparation of the above salt to evaporate over sulphuric acid; a reddish-brown, crystalline powder is obtained, which is not, however, the pure salt; when dissolved in water, it is not precipitated by alcohol; with nitrous acid, it yields the preceding salt; with potassium chloride, it does not give a precipitate, and when the mixture is allowed to evaporate over sulphuric acid, the corresponding potassium salt is obtained as a brown, microcrystalline powder. The *barium* salt, $2BaO,Co_2O_3,4N_2O_3 + 10H_2O$, is obtained by allowing the deep red solution which is formed in the preparation of the preceding barium salt to evaporate over sulphuric acid; it crystallises in dark red crystals mixed with the yellow barium salt, barium nitrite, or cobalt nitrate, and has not yet been obtained in a pure state. The *strontium* salt, with $11H_2O$, is obtained by treating a mixture of cobalt carbonate (1 mol.) and strontium carbonate (1 mol.) with nitrous acid until a clear solution is obtained; when this solution is allowed to evaporate over sulphuric acid, it separates in small, red crystals.

Salt of the composition $2RO,Co_2O_3,3N_2O_3 + xH_2O$.—The *zinc* salt, with $11H_2O$, obtained by treating a mixture of cobalt carbonate and zinc oxide with nitrous acid, crystallises in deep red, almost black, monoclinic pyramids. When dissolved in dilute acetic acid and treated with potassium chloride, it yields a precipitate of the salt $3K_2O,Co_2O_3,6N_2O_3$, and, with ammonium salts, the corresponding ammonium salt. When treated with silver nitrate in concentrated solution, it yields the *salt* $2Ag_2O,Co_2O_3,3N_2O_3 + 3H_2O$, which is sparingly soluble in water, and, when boiled with water, decomposes, with the formation of silver nitrite. The *cobalt* salt, $2CoO,Co_2O_3,3N_2O_3 + Co(NO_3)_2 + 14H_2O$, obtained by treating cobalt carbonate suspended in water with nitrous acid, and allowing the brown solution to evaporate at the ordinary temperature, forms small, black crystals, and, when treated with silver nitrate, yields the preceding silver salt.

The authors were unable to obtain a cobaltmonammine nitrite by the reduction of the above salts; but they obtained diammine nitrites or triammine nitrites.

When potassium cobalt hexanitrite is warmed with potassium cyanide solution, it is converted into potassium cobalt cyanide, with evolution of gas.

The *sodium cobalt nitrocyanide*, $Na_6Co_4(CN)_{10}\cdot NO_2 + 11H_2O$, obtained by adding solid sodium cyanide to a well-cooled solution of the red salt, $CoNa_2(NO_2)_4\cdot OH$, crystallises in microscopic needles, explodes when heated, and gives off red, nitrous fumes when treated with acids. When potassium cyanide is employed instead of sodium cyanide, a green salt is obtained, mixed with cobalt potassium cyanide; this green salt, which cannot be obtained pure, explodes when heated, and is similar to the sodium salt.

Potassium cobalt nitrocyanide, $K_4Co_2(CN)_9 \cdot NO_2 + 3H_2O$, obtained by treating an ice-cold solution of the salt $K_4Co(CN)_6$ with nitrous acid, is precipitated by alcohol as a deep red oil, which usually solidifies after a time; it is stable when dry, but quickly decomposes in solution, and yields red precipitates of the corresponding salts when treated with silver, barium, lead, or mercury salts. The *silver* salt,

$$Ag_5Co_2(CN)_{10} \cdot NO_2 + xH_2O,$$

is a bright carmine red, amorphous powder, and is insoluble in water.

E. C. R.

Permolybdates. By WILHELM MUTHMANN and WILHELM NAGEL (*Zeit. anorg. Chem.*, 1898, **17**, 73—81).—The authors have prepared the permolybdates as described by Bärwald (*Chem. Centr.*, 1885, 424), and Péchard (Abstr., 1891, 988; 1892, 1160, 1283, 1383) and find that these compounds have a different composition to that previously assigned to them.

The analysis of the salts is carried out as follows: the molybdenum is weighed as trioxide; in the case of ammonium salts this is obtained by heating the salt over a Bunsen burner; in the case of the other salts, the molybdenum is precipitated as sulphide, and this is then roasted. The oxygen is determined by titration with permanganate in acid solution, the permolybdic acid behaving with permanganate in the same way that hydrogen peroxide does; the ammonia is distilled and titrated, and the potassium weighed either as chloride or sulphate.

Ammonium salts.—When ordinary ammonium molybdate,

$$(NH_4)_6Mo_7O_{24} + 4H_2O,$$

is dissolved in a carefully purified 20 per cent. solution of hydrogen peroxide, an orange-red and a lemon-yellow salt are formed. The *orange-red* salt, $3(NH_4)_2O,7MoO_4 + 12H_2O$, is obtained by allowing the saturated hydrogen peroxide solution to crystallise for 2 hours over phosphoric anhydride; it separates in beautiful, monoclinic crystals. The *lemon-yellow* salt, $3(NH_4)_2O,5MoO_3,2MoO_4 + 6H_2O$, crystallises when the mother liquors of the preceding salt are concentrated further.

Potassium permolybdate, $K_2O,2MoO_3,MoO_4 + 3H_2O$, is obtained by dissolving potassium trimolybdate, $K_2Mo_3O_{10} + 3H_2O$, in hydrogen peroxide solution, and after separating a small quantity of amorphous precipitate, allowing the solution to evaporate over phosphoric anhydride, and then adding small crystals of the ammonium salt in order to start the crystallisation; it crystallises in minute, lustrous, bright yellow crystals belonging to the monoclinic system.

The assumption that hydrogen peroxide is present as such in these salts is supported by their behaviour towards potassium permanganate, also with chromic acid in sulphuric acid solution they give the blue coloration of perchromic acid, which is, however, quickly reduced; with a very dilute solution of potassium dichromate, aniline, and oxalic acid, they yield the reddish-violet coloration characteristic of hydrogen peroxide; and they are extremely sensitive to alkali, a few drops of potassium hydroxide or ammonia being sufficient to decolorise them with a brisk evolution of oxygen. Against the assumption of the presence of hydrogen peroxide is the yellow colour of the salts; and the fact that the finely powdered ammonium salt, after remaining in a vacuum over phosphoric anhydride for three weeks, contained molybdenum and oxygen in the same ratio as when freshly prepared, although the ammonia and water were given off.

When heated, the orange ammonium salt decomposes at 105°, the yellow salt at 170°, and the potassium salt at 180°. When treated with sodium phosphate in dilute nitric acid solution, they do not give a precipitate; in concentrated solutions, the orange ammonium salt also gives no precipitate, but the yellow salt yields a precipitate varying from 30—40 per cent. of the molybdic acid, according to the concentration. When an aqueous solution of the orange ammonium salt is subjected to electrolysis, oxygen is evolved at the anode, and hydrogen at the cathode, whereby reduction and decolorisation take place, and finally lower oxides of molybdenum are deposited.

The above results are similar to those obtained by Piccini (Abstr., 1892, 784) by the action of hydrogen peroxide on fluoroxymolybdates whereby fluoroxypermolybdates are formed. E. C. R.

Action of Hydrogen Sulphide on Vanadates. By JAMES LOCKE (*Amer. Chem. J.*, 1898, 20, 373—376).—When sodium orthovanadate is heated to 500—700° in a current of hydrogen sulphide, the latter is absorbed vigorously with production of sodium trithioorthovanadate, Na_3VOS_3. Sodium pyrovanadate reacts in a similar manner, giving rise to *sodium pentathiopyrovanadate*, $Na_4V_2O_2S_5$, which, in the crystalline condition, resembles potassium permanganate in colour and lustre; when the hot salt is exposed to the air, it catches fire, gives off sulphurous anhydride, and is converted into sodium hypovanadate. The salt is very hygroscopic, and dissolves in water, to form a deep reddish-purple solution, rapidly changing in colour as hydrogen sulphide is given off, and finally becoming colourless. This colour change is accompanied by a remarkable alteration in the colour of the free thiovanadic acid, which separates on addition of hydrochloric acid. From the freshly prepared solution, the precipitate is black, and from the nearly oxidised solution is pale orange. These acids are, however, so unstable as to render their isolation in a pure state practically impossible.

In conjunction with J. S. North, the author has tried to prepare the thiovanadates of several of the heavy metals by this method. Lead vanadate alone yielded what seemed to be a definite compound in the form of a black, lustrous, crystalline powder of the probable composition $Pb_2V_2O_5S_2$. A. W. C.

Sulphides. By VL. STANEK (*Zeit. anorg. Chem.*, 1898, 17, 117—125).—Silver sulphide (0·1 gram) when heated in a sealed tube with colourless ammonium sulphide (50 c.c.) for 4 hours at 150—200°, is obtained in beautiful, lustrous, black crystals, but when a relatively larger amount of silver sulphide is employed, only indefinite crystals and crystalline incrustations are found. Thallium sulphide, treated in the same manner, is obtained in black, thin, six-sided plates and needles. Copper sulphide is obtained after prolonged action of the ammonium sulphide in thin, violet, six-sided leaflets. Cadmium and zinc sulphides are converted into crystalline powders. Cobalt, nickel, iron, bismuth, and lead sulphides remain unaltered even after 8 hours heating at 200°.

Two *ammonium thioantimonites* are obtained by the action of colourless ammonium sulphide on roughly powdered antimonite. The *compound* $NH_4SbS_2 + 2H_2O$, which is obtained at lower temperatures, crystallises in yellow, thin, four-sided needles or leaflets, has a violet fluorescence, and is insoluble in water; it decomposes on exposure to air, is insoluble in water, and when gently warmed loses part of the ammonium sulphide and all its water, and turns red without any alteration in crystalline form; when heated at 105°, it is converted into the following compound. It is decomposed by dilute acids, with the formation of antimony sulphide and hydrogen sulphide, and by potassium hydroxide with evolution of ammonia. The corresponding *potassium* salt separates in red crystals, and is soluble in water. The *compound*, $(NH_4)_2Sb_4S_7$, obtained by heating orange-red antimony sulphide or powdered antimonite with ammonium sulphide in a sealed tube at 150°, crystallises in beautiful, red needles, is stable on exposure to air, is not decomposed by heating at 200°, and at higher temperatures is decomposed into antimony sulphide and ammonium sulphide; it is insoluble in boiling water, and behaves like the preceding salt with acids and alkalis. The corresponding *potassium* salt separates in red crystals, with $3H_2O$, which turn brown and then black on exposure to light.

Ammonium thioantimonate, $(NH_4)_3SbS_4$, obtained by dissolving powdered antimonite and flowers of sulphur in red ammonium sulphide and recrystallising the product from colourless ammonium sulphide, crystallises in pale yellow prisms, which, after removal of the mother liquor, quickly decompose and become brown, and are easily soluble in water; it is decomposed by dilute acids, with formation of antimony pentasulphide and hydrogen sulphide, and when heated in carbonic anhydride yields ammonium sulphide, sulphur, and antimony trisulphide. When heated with antimony pentasulphide in a sealed tube at 150°, it is converted into the compound $(NH_4)_2Sb_4S_7$. It is obtained crystallising, with $4H_2O$, in aggregates of colourless needles by saturating colourless ammonium sulphide with antimony pentasulphide, adding an equal quantity of ammonium sulphide and then alcohol until a precipitate commences to form; the filtered solution is then covered with a layer of alcohol and allowed to remain.

Ammonium thiostannate, $(NH_4)_2SnS_3 + 3H_2O$, is obtained by saturating colourless ammonium sulphide with stannic sulphide, adding an equal quantity of ammonium sulphide, and then precipitating with alcohol; it crystallises in thin, yellowish tablets which quickly turn yellow on exposure to air, yields a slightly turbid solution with water which gradually deposits tin sulphide, and is decomposed by acids with the formation of stannic sulphide and hydrogen sulphide. It is obtained with $7H_2O$, crystallising in beautiful, long, nacreous needles by covering a clear solution with a layer of alcohol and allowing the mixture to remain for some time. The *potassium* salt, K_2SnS_3, is formed by boiling tin and sulphur with potassium sulphide; on adding alcohol to the solution, the salt is obtained as a yellow or brown oil with $9—10H_2O$. E. C. R.

Bismuthous Oxide. I. By LUDWIG VANINO and F. TREUBERT (*Ber.*, 1898, **31**, 1113—1118).—The substance obtained by fusing bismuth in contact with air is not bismuthous oxide, but a mixture of the ordinary oxide with the metal. When a solution of bismuth nitrate or oxychloride is treated with excess of stannous chloride and a large excess of 10 per cent. aqueous soda is added, the precipitate is not bismuthous oxide, but bismuth itself; the small amount of tin which it contains can be removed by washing with cold, dilute hydrochloric acid. The precipitate obtained by using only 1 mol. of stannous chloride, instead of 3, for every 2 atoms of bismuth present has been described as bismuthous oxide, but it is probably a mixture of the metal with the metahydrate. C. F. B.

Isomorphism between Salts of Bismuth and of the Rare Earths. By GÖSTE BODMAN (*Ber.*, 1898, **31**, 1237—1240).—Just as thallium salts are isomorphous with those of potassium, rubidium, and cæsium, it is to be expected that salts of bismuth are related in this way to those of scandium, yttrium, and lanthanum. The author shows that a solution containing bismuth and neodymium nitrates yields mixed crystals of varying specific gravity and composition; the two salts in question exhibit isodimorphism, the stable $Bi(NO_3)_3 + 5H_2O$ yielding mixed crystals with the unstable salt, $Di(NO_3)_3 + 5H_2O$, whilst the stable $Di(NO_3)_3 + 6H_2O$ unites in a similar manner with unstable $Bi(NO_3)_3 + 6H_2O$.

The analogous relationship between bismuth nitrate and the nitrates of lanthanum and yttrium has been also established. M. O. F.

Mineralogical Chemistry.

Heavy Liquid for Separating Minerals. By WILHELM MUTHMANN (*Zeits. Kryst. Min.*, 1898, **30**, 73—74).—Acetylene-tetrabromide, $CHBr_2 \cdot CHBr_2$, which may be easily prepared by passing acetylene into bromine, has sp. gr. = 3·0011 at 6°, and refractive index = 1·6479 for sodium light. It is stable, and does not act on metallic minerals, and is miscible in all proportions with ether, benzene, toluene, &c. It has the advantage of not darkening by exposure to light, and in being less than one-tenth the cost of methylenic iodide (sp. gr. = 3·35). The high refractive index also renders it available for optical purposes in place of monobromonaphthalene. L. J. S.

Stanniferous Argyrodite from Bolivia; Identity of "Crystallised Brongniardite" with Argyrodite. By GEORGE T. PRIOR and LEONARD J. SPENCER (*Min. Mag.*, 1898, 12, 5—14).—The cubic minerals argyrodite and canfieldite, which contain the rare element germanium, have already been noted from Bolivia by Penfield (Abstr., 1894, ii, 18, 458). The canfieldite actually analysed by him contained the canfieldite and argyrodite molecules in the proportion of 12 : 5, namely, $12(4Ag_2S,SnS_2) + 5(4Ag_2S,GeS_2)$, whilst in the Bolivian, as well as in the original Freiberg, argyrodite no tin is present.

The material now described contains these two isomorphous molecules in different proportions, and is nearer to argyrodite than to canfieldite. It comes from Aullagas, dept. Potosi, and is associated with pyrargyrite, together with a little stephanite, blende, pyrites, barytes, and kaolin. Two types of the very symmetrically developed crystals are distinguished: (1) simple untwinned octahedra, usually with narrow dodecahedral planes, *d*{110}, and (2) dodecahedral crystals always twinned, and never with octahedral planes. The mineral is iron-black, with a dull, metallic lustre; the fracture is even, with a finely granular appearance. Analysis by G. T. Prior gave,

Ag.	Ge.	Sn.	S.	Fe.	Sb.	Total.	Sp. gr.
74·20	4·99	3·36	16·45	0·68	trace	99·68	6·19

The trace of antimony is due to the presence of pyrargyrite. Formula, $5(4Ag_2S,GeS_2) + 2(4Ag_2S,SnS_2)$. A convenient method for detecting germanium is to heat the mineral in a current of hydrogen, when there is a deep reddish-brown and black sublimate of germanium subsulphide and metallic germanium formed on the sides of the tube; this is dissolved off by nitric acid, and from the solution of the sulphide in ammonium sulphide, the bulky, pure white germanium bisulphide is precipitated on adding a large excess of sulphuric acid.

Brongniardite was described by Damour, in 1849, as a massive mineral from Bolivia having the composition PbS,Ag_2S,Sb_2S_3. Five years later, he described cubic crystals, which, from a blowpipe examination, he stated to be crystals of brongniardite. A re-examination of these crystals, from Aullagas, shows that they contain germanium, tin, and about 72 per cent. of silver, and that they are identical in all their characters with the argyrodite described above.

The sulphostannates at present known to occur as minerals are—canfieldite, stannite, franckeite, kylindrite (Abstr., 1893, ii, 576), and plumbostannite, all of which, with the exception of stannite, occur only in the Bolivian region. As pointed out by Stelzner (this vol., ii, 121), the Bolivian silver-tin veins are of an exceptional character, and it is just under these conditions that sulphostannates would be likely to be found. L. J. S.

Gypsum in Kansas. By GEORGE P. GRIMSLEY (*Jahrb. f. Min.*, 1898, i, Ref., 259—260; *Kansas Univ. Quart.*, 1897, **6**, A, 15—27; and *Bull. Geol. Soc. Amer.*, 1897, **8**, 227—240. Compare Abstr., 1897, ii, 415).—The extensive gypsum deposits occurring in the Permian rocks of Kansas are described. The following varieties are found: granular gypsum rock; large crystals; satin spar; and "dirt"; the last is an earthy powder of dark colour, and consists of small crystals of gypsum and quartz, with some calcite, and traces of organic matter. The massive gypsum was deposited in gulfs of the Permian seas, whilst the "dirt" is a recent deposit from springs. Analyses are given of: I, Gypsum rock from Hope; II, white gypsum from Medicine Lodge; III, "dirt" from Dillon; IV, "dirt" from Longford.

	SiO_2.	Fe_2O_3.	$CaSO_4$.	$CaCO_3$.	$MgCO_3$.	H_2O.	Total.
I.	0·34	0·16	76·98	1·68	1·38	19·63	100·17
II.	0·19	0·10	77·46	1·43	0·34	20·48	100·00
III.	12·13	0·99	64·63	3·57	0·88	16·80	99·00
IV.	18·69	1·21	56·56	6·10	0·90	15·54	99·00

L. J. S.

Kubeite. By L. DARAPSKY (*Jahrb. f. Min.*, 1898, i, 163).—This name is given to deep red crystals from near the river Loa, in the desert of Atacama; they are orthorhombic or monosymmetric pyramids, with a vitreous lustre, and are very brittle. Analysis gave,

SO_3.	Fe_2O_3.	Al_2O_3.	MgO.	CaO.	Insol.	H_2O.	Total.
36·4	19·3	Nil.	7·8	[0·1]	2·7	33·7	100·0

This agrees approximately with the formula $2(Fe_2O_3,2SO_3) + 3(MgO,SO_3) + 30H_2O$, and is analogous to the magnesia alum common on the coast of Chili. L. J. S.

The Occurrence and Extraction of Thorite, Monazite, and Zircon. By P. TRUCHOT (*Chem. News*, 1898, **77**, 145—147).—*Monazite.*—This mineral occurs at Cleveland, North Carolina, in crystals, only slightly decomposed, and disseminated in coarse mica (both muscovite and biotite); the ground is also rich in thoria; it is worked to a depth of 1·2 to 1·8 metre and is sluiced. In Idaho, monazite occurs as a constituent of granite and also in sands associated with zircon, ilmenite, &c., or with rutile, garnet, &c. In Ottawa Co., Canada, it is associated with mica, garnet, tourmaline, &c. Large supplies, too, are drawn from sandbanks on the sea shore of Bahia province, Brazil; these sands contain a notable proportion of monazite and 4 to 5 per cent. of thoria, and are directly loaded on board ship; in Brazil, it is also found, in nodular masses, coloured by orangite, in the gold and diamond placers in the provinces of Minas Geraes, Cuyaba, and Goyaz, also in the provinces of San Paulo and Rio de Janeiro. Other localities are Antioquia, New Granada; the United States of Columbia; the sands of the Buenos Ayres river in the Argentine Republic, &c. In the following table, the average composition of monazite and monazite sands from different localities is given.

Monazite.	P_2O_5.	Ce_2O_3.	La_2O_3.	Di_2O_3.	Yt_2O_3.	ThO_2.	SiO_2.	Al_2O_3.	Fe_2O_3.
I. Mount Ilmen …	27·32	31·31	31·86	—	0·52	5·55	1·37	0·13	0·26
	19·31	22·88	14·69	—	1·71	16·64	9·67	2·90	—
II. Antioquia……..	29·10	46·14	24·50	—	—	—	—	—	—
III. Caravellas, Brazil	28·70	31·30	39·90		—	—	—	—	—
IV. Burke Co., N. Carolina	29·23	31·38	30·88		—	6·49	1·40	—	—
V. Amelia Co., Virginia	26·12	29·89	26·66		—	14·23	2·85	—	—
VI. Ottawa Co., Canada	26·86	24·84	26·41		4·76	12·60	0·91	—	1·07
Monazite sands.									
VII. Burke Co., N. Carolina	18·38	32·93(CeO)	7·93		—	1·43	6·40	1·62	—
VIII. Shelby, N. Carolina	28·16	63·80			—	2·32	3·20	—	—
IX. Bellewood, N. Carolina	26·05	59·09			—	1·19	1·45	0·15	—

	FeO.	MnO.	CaO.	MgO.	ZrO_2.	SnO_2.	PbO.	Ta_2O_5.	TiO_2.	H_2O.
I.	—	—	0·55	—	—	0·95	—	—	—	0·41
	3·56	4·89	1·25	0·40	—	0·40	—	—	—	0·71
II.	—	—	—	—	—	—	—	—	—	—
III.	—	—	—	—	—	—	—	—	—	—
IV.	—	—	—	—	—	—	—	—	—	0·20
V.	—	—	—	—	—	—	—	—	—	0·67
VI.	—	—	1·54	0·04	—	—	—	—	—	0·78
VII.	7·83	—	1·20	—	13·98*	—	traces	0·66	4·67	—
VIII.	—	traces	—	—	1·52*	—	—	—	0·61	—
IX.	0·65		—	—	2·68*	—	—	6·39	1·40	—

* + Y_2O_3.

Zircon.—Well known localities of occurrence are duly recorded, and, in addition, certain recent discoveries in North Carolina, Colorado, Idaho, and Texas, where zircon is associated with monazite. The largest deposit, 105 acres in extent, is situated to the north-east of Tasmania, 20 to 30 cm. below the surface, in a gravel bed 20 cm. thick, which rests on a bed of blue clay 60 cm. thick. The deposit consists almost entirely of zircon with variable quantities of lanthanium, didymium, thorium, niobium, erbium, cerium, and chromium. The average composition of zircons is as follows.

	Ceylon.	Norway.	Colorado.	New Zealand.
SiO_2 ……………	33·85	33·61	29·70	33·50
ZrO_2 …………	64·25	64·40	60·98	63·80
FeO ……………	1·08	0·90	9·20	2·07
MgO …………	—	—	0·30	0·12

D. A. L.

Artificial Scorodite. By Hermann Metzke (*Jahrb. f. Min.*, 1898, i, 169—170).—By heating various ferric arsenates with an aqueous solution of arsenic acid in sealed tubes, crystalline precipitates were obtained having approximately the composition of scorodite ($FeAsO_4 + 2H_2O$). In one experiment (in the presence of hydrogen peroxide) distinct crystals of scorodite were produced, together with orthorhombic crystals having perhaps the composition $2FeAsO_4 + H_2O$. Crystalline material was also obtained by the evaporation of a hydrochloric acid solution of ferric arsenate. L. J. S.

Position of Bliabergite in the Mineral System. By Mats Weibull (*Jahrb. f. Min.*, 1898, i, Ref., 246—247; from *Geol. För. i Stockholm Förh.*, 1896, 18, 515).—A re-examination of the mineral recently described by Igelström under the name bliabergite or bliabergsite (Abstr., 1897, ii, 268), shows it to be a brittle mica near chloritoid or ottrelite. It occurs as rounded, rarely hexagonal, plates, which, when fresh are greyish-green, and have a hardness = 7, sp. gr. = 3·6. There is a distinct cleavage in one direction. Optical examination shows it to be monosymmetric, strongly pleochroic, and to enclose much hæmatite, kyanite, quartz, and limonite. Owing to these impurities, the analyses are unsatisfactory (compare Barrow, this vol., ii, 389). The iron ores were dissolved by hydrochloric acid, and the quartz separated by a heavy solution, but the material so obtained still contained 15—20 per cent. of kyanite; the portion of this soluble in sulphuric and hydrofluoric acids gave I, which is taken to represent the composition of the bliabergite. Analysis of purer material gave II, after deducting 20 per cent. of kyanite.

	SiO_2.	Al_2O_3.	FeO,MnO.	MgO.	H_2O.
I.	37·59	25·50	29·31	0·65	6·97
II.	40·07	32·39	21·06	1·20	4·06

A structural formula is given. Bäckström, from an optical examination, also concludes that bliabergite is an altered ottrelite.

L. J. S.

Sphærostilbite. By George T. Prior (*Min. Mag.*, 1898, 12, 26—29).—It is shown that the material called sphærostilbite, from the Faröe Islands, and other localities, has the optical characters and the chemical composition of thomsonite and not of stilbite. Material from the Faröe Islands consists of a sort of open network of confusedly-grouped and imperfect crystals, presenting pearly cleavage surfaces, and resembling stilbite, disposed on ordinary compact mesole (faröelite), the presence of which determines the spherical form. Both of these portions have the optical characters of thomsonite; and material from the outer zone carefully separated from the more compact spheres of mesole, gave the following results on analysis.

SiO_2.	Al_2O_3.	CaO.	Na_2O.	H_2O.	Total.
40·69	28·63	12·98	5·66	12·42	100·38
41·47	28·69			12·63	

In all probability, the sphærostilbite originally described by Beudant in 1832 does not exist, and that described by Heddle is probably identical with the material now shown to be thomsonite; the name sphærostilbite must therefore be discarded. L. J. S.

Senaite, A New Mineral of the Ilmenite Group, from Brazil. By Eugen Hussak and George T. Prior (*Min. Mag.*, 1898, 12, 30—32). —This new ilmenite-like mineral occurs as rounded fragments and rough crystals in the diamond-bearing sands of Diamantina in Minas Geraes. The crystal system is rhombohedral, tetartohedral (trigonal rhombohedral of Groth); $a : c = 1 : 0·997$. The crystals are very rich in faces and are frequently twinned. The colour is black, with submetallic lustre, and the powdered mineral is brownish-black; very thin splinters are transparent with an oil-green to greenish-brown colour. There is no cleavage, and the fracture is conchoidal. The sp. gr. of crystals is given as $= 4·22$, 5·08 and 5·301, these differences being apparently due to decomposition, as the crystals are sometimes coated with brown limonite, or with a yellow crust consisting of titanic acid with only a trace of iron. The mineral is infusible before the blowpipe, and is decomposed by hydrofluoric acid, by boiling sulphuric acid, and by fusion with acid potassium sulphate. Analysis by G. T. Prior of the rounded fragments of sp. gr. $= 4·78$, and apparently quite fresh and homogeneous, gave

TiO_2.	PbO.	FeO.	Fe_2O_3.	MnO.	MgO.	SnO_2.	Total.
57·21	10·51	4·14	20·22	7·00	0·49	0·11	99·68

Considering all the iron to be FeO, and the manganese MnO_2, the formula is approximately $(Fe,Pb)O,2(Ti,Mn)O_2$. The amount of titanic acid is much too great for the ordinary ilmenite formula, FeO,TiO_2, advocated by Penfield and Foote (this vol., ii, 122). Other analyses of ilmenite showing the same excess of titanic acid are those by Mackintosh (Abstr., 1885, 878) and Peek (Abstr., 1897, ii, 328); and of Janovsky's iserite the formula is $FeO,2TiO_2$. L. J. S.

Chemical Constitution of the Chlorite Group. By K. Dalmer (*Jahrb. f. Min.*, 1898, i, Ref. 165—168).—Tschermak has assumed the chlorites to be mixtures in various proportions of silicates having the composition of serpentine, amesite, &c. The fundamental molecules assumed by the present author are chloritoid and olivine. L. J. S.

So-called Hornblende-gneisses in Moravia. By Conrad H. von John (*Jahrb. f. Min.*, 1898, i, Ref. 279; from *Verh. geol. Reichsanst.*, 1897, 189—193).—Several so-called hornblende-gneisses from various localities in Moravia are shown to have a mineralogical composition and structure between syenite and diorite, and they may therefore be called monzonite (of Brögger). Plagioclase felspar is slightly more abundant than orthoclase, both hornblende and biotite are present, and there is very little quartz. Analysis I, of the rock from Chudoba, Bohemia; II, from Hackelsdorf, Moravia.

	SiO_2.	Al_2O_3.	Fe_2O_3.	FeO.	CaO.	MgO.	K_2O.	Na_2O.	P_2O_5.	Loss on ignition.	Total.
I.	57·79	17·58	1·79	5·32	5·80	3·85	3·11	3·43	0·49	0·66	99·82
II.	58·18	17·00	2·02	5·20	5·90	3·93	2·96	3·40	0·32	0·74	99·65

L. J. S.

Meteoric Iron from Ballinoo, Western Australia. By Emil W. Cohen (*Ber. Akad. Berlin*, 1898, 19—22. Compare this vol., ii, 342).—As before mentioned, this is an octahedral iron consisting mainly of plessite with very fine lamellæ of kamacite and tænite. Analysis by O. Sjöström gave,

Fe.	Ni.	Co.	Cu.	C.	P.	S.	Total.	Sp. gr.
89·34	9·87	0·60	0·06	0·02	0·48	0·03	100·40	7·8432

This corresponds with the mineralogical composition: nickel iron, 96·81; schreibersite, 3·11; and troilite, 0·08 per cent. L. J. S.

Composition of the Atlantic Ocean. By CHARLES J. S. MAKIN (*Chem. News*, 1898, **77**, 155—156, 171—172).—Samples of water from the Atlantic Ocean were taken daily at noon, during a homeward voyage from the Cape; there were twenty-two samples in all. The total solids were determined in each sample, and varied from 34·51 per 1000 (taken during a continued heavy rain) to 37·39 per 1000 (taken at Teneriffe, 200 yards from shore, in about 11 fathoms). The samples were mixed, and a full analysis made of the average sample so obtained; it had a sp. gr. = 1·0275 at 15·5°, and contained, in parts per 1000: Total solids, 36·31; Cl, 20·6569; Br, 0·0671; CO_2, combined, 58·46; CO_2, free, 5·11; SO_3, 24·679; CaO, 0·6518 (vol.); MgO, 2·4270; Na_2O, 1·5266; K_2O, 0·049952. Ammonia (milligrams per litre), free, 0·192; combined, 0·362; albuminoid, 0·558; organic matter, equal to 10·40 and 11·00 milligrams of oxygen per litre. The various methods of analysis employed are recorded. D. A. L.

Physiological Chemistry.

Fat Absorption. By OTTO FRANK (*Zeit. Biol.*, 1898, **36**, 568—593).—Ethylic salts of the higher fatty acids are (with the exception of the stearate) taken up in large quantities from the dog's alimentary canal. Before absorption, they are completely broken up in the small intestine, so that not the smallest quantity appears in the chyle. It is quite certain that, in the absorption of fat, there is a synthesis of triglycerides from fatty acids and glycerol. In the chyle, some of the fat originates from the intestine and its juices. W. D. H.

The Formation of Urea in the Liver of Mammalia from Amido-acids of the Fatty Series. By SERGEI SALASKIN (*Zeit. physiol. Chem.*, 1898, **25**, 128—151).—By means of experiments on dogs, similar in principle to those by means of which Schröder established the fact that ammonium salts are transformed in the liver into urea, it is shown that the liver can form urea also from the amido-acids, glycocine, leucine, and aspartic acid. Whether other nitrogenous compounds, such as proteoses, peptone, carnic acid, &c., act similarly, has yet to be tested. W. D. H.

Variations in the Activity and Composition of Human Mixed Saliva. By RUSSELL H. CHITTENDEN and A. N. RICHARDS (*Amer. J. Physiol.*, 1898, **1**, 461—476).—A full account of experiments previously published (see this vol., ii, 241). W. D. H.

The Contents of Occluded Portions of the Intestine. By Waclaw von Moraczewski (*Zeit. physiol. Chem.*, 1898, **25**, 122—127).—In a dog, the ileum, cæcum and commencement of the colon were ligatured off from the rest of the alimentary canal; the continuity of the rest of the canal was then restored, the animal recovered well, and was killed a year later. The ligatured intestine presented the appearance of a sac, the contents of which resembled meconium in appearance, and contained numerous bacteria (not *Bacterium coli*). Analysis showed 74 per cent. of water, and the solid residue yielded neutral fat, 10; cholesterol and stercorin, 6; pigment (dissolved out with amylic alcohol), 5; fatty acids, 27; proteid, 1; salts, 20; chlorides, 0·03 per cent.; 31 per cent. of the solids are left unaccounted for. The material is remarkable for its high percentage of salts. Sugar, enzymes, indole, lecithin were absent. The material had a scatole-like odour.

In another dog, a similar operation involved a part of the ascending colon. A year later, the sac contained an uncoloured, strongly alkaline liquid, with a scatole-like odour, and the appearance of a transudation. The contents of this were chiefly water and salts, especially sodium carbonate; there was a little proteid, but no sugar, fat, cholesterol, or lecithin.

On the strength of these two experiments, the conclusion is drawn that the small intestine secretes pigments, fat, and calcium salts; the large intestine, almost nothing else but sodium carbonate.

W. D. H.

Comparative Composition of Blood. By Emil Abderhalden (*Zeit. physiol. Chem.*, 1898, **25**, 65—115. Compare this vol., ii, 35, 415).—A large number of analyses of the blood of various oxen, sheep, goats, horses, pigs, rabbits, dogs, and cats are given in a series of tables.

W. D. H.

Intestinal Absorption and Saline Cathartics. By George B. Wallace and Arthur R. Cushny (*Amer. J. Physiol.*, 1898, **1**, 411—434).—The absorption of the salts of the fixed alkalis varies with the anions, those acids which form insoluble calcium salts tending to retard absorption more than others. The behaviour of these salts in the intestine has much in common with their action on unorganised colloid matter, as they tend to precipitate colloids in solution, and are less imbibed than other salts by undissolved colloids. But no complete analogy in their behaviour towards the tissues in general exists, for several of the cathartic salts permeate the red corpuscles freely, and others are absorbed rapidly from the serous membranes.

As regards the cathions, ammonium is absorbed more rapidly than the fixed alkali ions, whilst those of the alkaline earths are very slowly taken up by the intestinal epithelium.

Dilute solutions (isotonic) of the saline cathartics retard the absorption of fluid from the stomach and small intestine, and thus act by rendering the contents more watery, and more easily moved through the lower parts of the alimentary canal.

W. D. H.

Secretion of Acids by Molluscs. By K. Schoenlein (*Zeit. Biol.*, 1898, **36**, 523—548).—It is well known that *Dolium galea* and other snails secrete from the glands at the anterior end of their alimentary canal a liquid rich in sulphuric acid (3 to 4 per cent.). Opportunity was afforded the author of obtaining a few specimens of these animals at Naples, and he confirms the observation. Microscopical examination of the glands shows that they resemble the submaxillary gland very much. It is not so generally known that the number of molluscs with similar acid secretions is very great. A list of these is given. In one case (*Pleurobranchidium meckelii*), the secretion of the skin is acid. In another case (*Tritonium*), which was more fully investigated, the secretion was acid, and contained proteid material. The acid is an organic, crystallisable, nitrogen-containing substance, which was not, however, identified.

The formation of gas-bubbles, so characteristic a feature of *Dolium*, is due to the action of the sulphuric acid on concretions of calcium carbonate.

The dissection of the glands, and the obtaining of the secretion in these large molluscs, is a matter of some difficulty; the shell is hard, and muscular tonus after a wound intense; this was to some extent overcome by keeping the animals at 30°, and injecting pelletierin.

W. D. H.

Noël-Paton's Crystalline Globulin. By KARL H. HUPPERT (*Centr. med. Wiss.*, 1898, No. 28).—The crystalline proteid described by Noël-Paton (Abstr., 1893, ii, 290) in a specimen of human urine, was regarded by Huppert (Abstr., 1897, ii, 221) as probably heteroalbumose. He has now had an opportunity of examining the actual material, and fully confirms Paton's statement that it is a globulin.

W. D. H.

Urine of Octopus Macropus. By K. SCHOENLEIN (*Zeit. Biol.*, 1898, **36**, 548).—This secretion is clear, colourless, and slightly acid; the cause of the acidity is still to seek. The acidity increases on evaporation. The urine contains a considerable amount of sodium chloride. There is also a deposit like sand, which consists of orange-red, globulo-crystalline concrements; these give the murexide reaction.

W. D. H.

Chemistry of Vegetable Physiology and Agriculture.

A New Organism, the Bacillus Tartricus, capable of Fermenting Tartrates. By LÉON GRIMBERT and L. FICQUET (*J. Pharm.*, 1898, [vi], **7**, 97—100).—Hitherto the fermentation of tartrates has only been studied in the case of impure cultures. By exposing a few drops of a vegetable infusion to the air at 35°, and making a series of anærobic cultures of the organisms developed, in solutions of tartrate and of gelatin, the authors have isolated a probably new organism, the *Bacillus tartricus*, which rapidly ferments calcium tartrate, converts nitrates into nitrites, and decomposes dextrose, lactose, maltose, cane-sugar, dextrin, and mannitol, but does not act on dulcitol or glycerol. No alcohol was formed on fermenting calcium tartrate at 36° with either ærobic or anærobic cultures of the organism in presence of Pasteur's nutrient fluid and a trace of peptone; acetic and succinic acids, together with hydrogen and carbonic anhydride, were alone obtained. Ammonium tartrate, under the same conditions, gave rise to acetic and succinic acids only. By these properties, the *Bacillus tartricus* is distinguished from the organisms capable of fermenting tartrates, which have been described by Pasteur, Gautier, Fitz, and König. W. A. D.

Nucleo-proteids of Bacteria. By GINO GALEOTTI (*Zeit. physiol. Chem.*, 1898, **25**, 48—63).—The question of immunity, and of toxins and anti-toxins produced by bacteria, is closely linked with that of the chemical composition of the micro-organisms themselves. Several previous researches (references to which are given) indicate that the proteid material they contain is nucleo-proteid.

The bacterium specially investigated during the present research was Ernst's *Bacillus ranicidus* (*Zeigler's Beiträge*, 1890, 203), large cultures of which were obtainable. The nucleo-proteid separated from this by the usual methods yielded xanthine bases; it contained a low percentage of nitrogen (12), whilst the phosphorus amounted to 1·01 to 1·8 per cent. It produced intravascular coagulation in rabbits, but small doses conferred immunity. The concluding portion of the paper relates to its colour reactions with aniline dyes. W. D. H.

Denitrifying Micro-organisms. By OTTO KÜNNEMANN (*Landw. Versuchs-Stat.*, 1898, **50**, 65—113).—The destruction of nitrates by micro-organisms was first established by Meusel (this Journal, 1876, 189). Horse-dung contains two kinds of micro-organisms which destroy nitrates, one of which (Burri and Stutzer's *Bacillus denitrificans I.*) is effective only in symbiosis with *Bacterium coli*, the other (which was also found in straw) is a variety of *Bacillus denitrificans II.* (Burri and Stutzer). The same micro-organisms were found in cattle dung, but they are not always present.

The loss of nitrates caused by denitrification may be not inconsiderable, but is less in soil poor in organic matter. Both exclusion of air and abundant aëration retard the action of *B. denitrificans I.*, but have no effect on *B. denit. II.*

Sulphuric acid is very effective in preventing denitrification, the micro-organisms being unable to develop in solutions containing 0·17 per cent. of the acid.

A number of soils were next examined for denitrifying organisms which were generally found to be present. The varieties were, however, usually different from those found in dung. The denitrifying bacteria found were *Bacillus pyocyaneus*, *B. fluorescens liquefaciens*, and a third, not previously described, *B. denitrificans III.* The activity of these microbes is equal to those found in dung. Their growth is stopped by 0·17 per cent. of sulphuric acid.

Denitrification is not disturbed by 0·1 per cent. of caustic lime, but is slower in presence of 0·25 per cent. With 0·5 per cent. of lime, *B. pyocyaneus* alone caused denitrification. Marl has no effect.

N. H. J. M.

Processes of Denitrification. By THEODOR PFEIFFER and OTTO LEMMERMANN (*Landw. Versuchs-Stat.*, 1898, **50**, 115—142).—An extension of Künnemann's experiments (preceding abstract). The variety of *B. denitrificans II.* found in straw liberated 89·93 per cent. of the nitric nitrogen in a Giltay solution as free nitrogen. In Giltay and Aberson's experiments (*Extrait Arch. Néerland*, **25**, 341), about 80 per cent. of the nitric nitrogen was liberated, whilst Burri and Stutzer recovered 98·9—99·6 as free nitrogen. A certain amount of the nitrogen of the nitrates was converted into organic nitrogen. In broth, 95·52 per cent. of the nitric nitrogen was liberated. Both in a Giltay solution and in broth, a considerable amount of carbonic anhydride was liberated, and in broth cultivations a certain amount of hydrogen was produced. It is, however, most improbable that the production of nascent hydrogen is the direct cause of denitrification; such an action would not stop at the point at which nitrates are produced, and a greater amount of elementary nitrogen would be formed than corresponds with the original nitrate. Finally, no hydrogen was detected during denitrification in a Giltay solution.

The different denitrifying organisms were cultivated in nitrate broth in air, oxygen, hydrogen, and carbonic anhydride respectively. Hydrogen slightly retarded denitrification; the micro-organisms thrive without oxygen, but seem to require air when they commence to develop. The bacteria did not grow in pure carbonic anhydride. With regard to air and pure oxygen, *B. denit. II. var.* was rather benefited than restrained by abundant aëration, but the other varieties seem to be injured. Assuming the denitrifying organisms found by Künnemann in soil to be the only ones present, aëration of soil would, at any rate, not increase loss of nitrogen through denitrification (compare Ehrenberg, Abstr., 1887, 172 and 746; 1888, 185).

With regard to the question of the injurious effect of fresh horse-dung, with and without nitrate, on the yield of crops (Wagner, *Landw. Versuchs-Stat.*, **48**, 238), experiments are described in which oats were grown in pots containing 27 kilos. of sandy soil, to which sodium nitrate (7·41 grams) and horse-dung (500 grams), both alone and mixed, were added. Some of the pots had, in addition, caustic lime (15 and 25 grams) and marl respectively. The results were much less unfavourable than those obtained by Wagner (*loc. cit.*, and *Deut. landw. Presse*, 9 Feb., 1895), the effect of sodium nitrate being, in the worst case, depressed from 70·8 to 42·4 per cent. This difference is attributed to the fact that Wagner added 2 grams of nitrogen (in dung) to 7 kilos. of soil, whilst in these experiments only 1·7 grams of nitrogen was added to 27 kilos. of soil; in presence of the greater amount of organic matter, the micro-organisms are more active. In the authors' experiments the amount of dung applied corresponds with over 480 lbs. per acre; moreover, fresh dung is rarely used in practice, and the experiments cannot therefore be considered unduly favourable. The actual loss, as free nitrogen, in practice is probably less important than is supposed, but further evidence is wanted.

Lime and marl slightly impeded denitrification, and the beneficial effect of the application of these substances to the soil is, in most cases, to be partly attributed to this action. N. H. J. M.

Two Moulds Capable of Producing Citric Acid. By CARL WEHMER (*Chem. Zeit.*, 1897, **21**, 1022—1023).—It has been found that the mould, *Penicillium luteum*, which has been previously described by the author from a morphological point of view (*Ber. botan. Ges.*, 1893, 4), is capable of producing citric acid from saccharine solutions. The amount of acid formed is always small, never more than 2—3 per cent. The mould grows readily on strongly acid substrata, and may readily be obtained together with *Aspergillus niger* by spontaneous growth. A second mould which is also capable of forming citric acid is *Mucor piriformis*, Fisch.; the amount of acid formed by this organism is greater than that by *Penicillium luteum*, but with both organisms it has been found that occasionally no trace of citric acid is formed, even when all conditions are practically identical. The second organism, when grown on steamed rice, develops a characteristic ethereal odour.

Experiments made with *Citromyces pfefferianus* have established the absolute necessity for oxygen in order that the organism may grow and that citric acid may be formed. J. J. S.

Assimilation of Iron from Cereals. By GUSTAV VON BUNGE (*Zeit. physiol. Chem.*, 1898, **25**, 36—47).—Analyses previously published of food materials have shown that, in comparison with rice, the cereals are very rich in iron. The greater quantity of this element is, however, in the husk or bran.

The author finds the amount of iron (in milligrams per 100 grams of dry substance) to be as follows.

Rice	1 to 2	Rye	4·9
Peeled barley	1·4 to 1·5	Wheat	5·5
Wheat meal	1·6	Wheat bran	8·8
Barley	4·5		

The question next arises whether the iron compound in the bran is assimilable, and experiments were made in parallel series on rats fed on bread, with and without bran respectively. It was found that the weight, the absolute quantity of hæmoglobin in the animal, and the amount of hæmoglobin per body weight were all increased in the case of those to which the bran was given to a greater extent than in the others. The conclusion is therefore drawn that the iron compound in the bran is assimilable and converted into hæmoglobin.

W. D. H.

Saps. II. By ALEXANDRE HÉBERT (*Bull. Soc. Chim.*, 1897, [iii], **17**, 88—91. Compare Abstr., 1896, ii, 494).—The sap of the European banana tree (*Musa ensete*) is distinguished from that of the foreign variety (*Musa paradisiaca*), previously described, by the absence of colouring matter and fatty acids, and by the presence of glucose. It is concluded that the processes of assimilation may differ considerably in different varieties of the same botanical species. N. L.

Mode of Formation of Elaterin in Ecballium Elaterium. By Armand Berg (*Bull. Soc. Chim.*, 1897, [iii], **17**, 85—88).—When the fruit of *Ecballium elaterium* is cut up and pressed, a turbid liquid is obtained which deposits a pale green powder, of which the chief constituent is elaterin. If, however, the entire fruit is rapidly pressed, the liquid obtained is at first clear, but soon becomes clouded. This phenomenon is explained by the fact that elaterin does not exist ready formed in the fruit, but is produced, after the rupture of the tissues, by the action of a ferment on a glucoside. Both of these substances have been isolated from the clear juice. The examination of the ferment, for which the name *elaterase* is suggested, is not yet completed. The *glucoside* is a very bitter, amorphous, yellowish powder, slightly soluble in water, very soluble in alcohol, chloroform, and acetone, but insoluble in ether and benzene. With sulphuric acid and phenol, it gives the same reactions as elaterin. N. L.

The Nature of the Reducing Sugar in Sugar-cane Sap, Cane-sugar Molasses, and Sorghum Products. By C. H. Pellet (*Bied. Centr.*, 1898, **27**, 357; from *Bul. inst. égypt*, and *Neue Zeits. Zuckerind.*, 1897, 237, 245, and 261).—Levulose and dextrose are present in sugar-cane juice, but in varying amounts. In sugar-cane poor in sugar, containing much reducing sugar, there is more levulose than dextrose, whilst in rich canes containing little reducing sugar there is more dextrose. The upper portions of the canes are richer than the lower in reducing sugar and contain more levulose, and *vice versâ*.

In determining the reducing sugar in sugar-cane juice, in order to estimate the amount of crystallisable sugar, the solution should be treated with lead solution which has been neutralised with acetic acid, otherwise a not inconsiderable amount of levulose is precipitated. In some cases, the raffinose must be determined. The reducing sugars from cane and from sugar-cane molasses ferment exactly in the same manner as invert-sugar, which they also resemble in their behaviour towards lime and alkalis.

In order to calculate the amounts of dextrose and levulose in sugar-cane juice (or the molasses), it is necessary to know (1) the difference between the direct polarisation and the actual crystallisable sugar determined by inversion ($-D$), and (2) the total amount of reducing substances (R), the rotatory power of levulose at the temperature at which the experiments were made, and the rotatory power of the dextrose. The levulose being x and its rotatory power L, the dextrose y and its rotatory power $0·793$: $0·973\,y - L \times x = -D$ and $x + x = R$. The general formula is then $x = R - y$, $y = \dfrac{RL - D}{L + 0·793}$.

N. H. J. M.

Presence of Amygdalin and Emulsin in the Seeds of Certain Pomaceæ. By Lutz (*Chem. Centr.*, 1897, ii, 1054; from *Rép. Pharm.*, 1897, 312).—The distillates obtained from the seeds of *Malus com-*

munis, *Cydonia vulgaris*, *Cydonia japonica*, and *Sorbus aria* contain hydrocyanic acid, and 0·032 gram of this acid is present in the seeds of *Sorbus aucuparia*. To test for emulsin, the cut surfaces of the seeds are moistened with Millon's reagent diluted with five times the volume of water acidified with nitric acid; the cells become rose-coloured, and, on warming, those which contain emulsin turn light brown.

E. W. W.

Iceland Moss. By ERNEST W. BROWN (*Amer. J. Physiol.*, 1898, **1**, 455—460).—The bitter constituents of the lichen *Cetraria islandica* (Iceland moss) must be removed by treatment with water or weak alkali before it can be made into palatable bread. Its composition is as follows.

Total nitrogen	0·56	per cent.
Extractives	0·14	,,
"Protein"	0·32	,,
Ether extract (fat and fatty acids)	1·2	,,
Crude fibre	5·3	,,
Fat	2·2	,,
Material soluble in 85 per cent. alcohol	16·1	,,
Soluble carbohydrates (as dextrose)	43·3	,,

The quantity of proteids is thus small and resists artificial digestion. The soluble carbohydrates are lichenin, and lichenin-starch or isolichenin. Lichenin gelatinises like starch, and by hydrolysis with acids is converted into dextrose with intermediate dextrins. Amylolytic enzymes have no action on it. From experiments on rabbits, the conclusion drawn is that it does not give rise to glycogen in the liver.

Isolichenin, which is obtained after filtering off the jelly formed by lichenin, is present in smaller quantity, gives a blue coloration with iodine, and somewhat resembles soluble starch. On hydrolysis with acid, it yields the same products as lichenin. With amylolytic enzymes, it forms dextrins, but no sugar. W. D. H.

Palm Cake and Palm Cake Meal. By ADOLPH EMMERLING (*Landw. Versuchs-Stat.*, 1898, **50**, 5—63).—*Acidity of palm cake.*—A number of samples of cake and meal were analysed and the results grouped according to the odour of the samples, some having a "fruity" odour, others being slightly rancid. The following average percentage results are given for (1) cake, (2) meal, and (3) crushed cake. The acid number represents milligrams of KOH per gram of fat.

	Proteids.	Fat.	Oleic acid.	Acidity.	Acid number.
Palm cake	17·12	7·85	2·36	32·0	63·4
Palm meal	16·49	8·19	3·83	48·5	96·6
Crushed cake	16·84	1·67	0·45	28·9	57·5

The acidity results, which are somewhat higher than those previously obtained (Nördlinger, Abstr., 1890, 929; Heinrich, *2te. Ber. Landw. Versuchs-Stat. Rostock*, 1894; H. Fresenius, *Landw. Versuchs-Stat.*, 1891, **38**, 296; and von Rümker, *Versuchs-Stat. Preussens, i J.*, 1894) show that, on the whole, the acidity of palm cake meal is higher than that of palm cake. The slightly rancid samples are somewhat more acid than the others, whilst the samples of a fruity odour are much more acid than those which did not have this odour. The acidity increases with decrease in amount of fat; the amount of acid remains (on the average) constant.

In the case of earth-nut cake, Reitmair (Abstr., 1891, 770) found the cakes richest in acid contained a low percentage of fat. This does not hold good in the case of palm cake, probably owing to the processes of manufacture of the two products being totally different (compare Emmerling, *Landw. Versuchs-Stat.*, 1897, **49**, 51).

With regard to the changes which take place when palm oil is kept, it was found that there was relatively little alteration in the amount of acid after two years. The volatile fatty acids increased slightly when the oil was exposed (4 months) to air. The iodine number diminishes when the oil is kept, and the change seems to be quickened under the influence of light. Exposure for 2 years considerably raised the acetyl number of palm oil. Palm cake kept for 2 years showed very little change in the amount of fat; there was a very slight gain in proteids not to be accounted for by loss of water.

Acidity increased very greatly when the cake was kept, whether exposed to light or in darkness, and in closed vessels. The iodine number of the cake increased after prolonged exposure.

N. H. J. M.

Composition of Humus. By HARRY SNYDER (*J. Amer. Chem. Soc.*, 1897, **19**, 738—744).—Humus prepared by mixing different kinds of organic matter with soil and keeping in a tight box for a year out of doors, was found to have the following composition.

Humus from:	C.	H.	N.	O.
Cow manure	41·95	6·26	6·16	45·65
Green clover	54·22	3·40	8·24	34·14
Meat scraps	48·77	4·30	10·96	35·97
Wheat flour	51·02	3·82	5·02	40·14
Oat straw	54·30	2·48	2·50	40·72
Sawdust	49·28	3·33	0·32	47·07
Sugar	57·84	3·04	0·08	39·04

The average composition of the ash of eight samples of precipitated humus was.

K_2O.	Na_2O.	CaO.	MgO.	Al_2O_3.	Fe_2O_3.	P_2O_5.	SO_3.	CO_2.	Insol.
7·50	8·13	0·09	0·36	3·48	3·12	12·37	0·98	1·64	61·97

A portion of the mineral matter is shown to have been derived from the soil.

Analysis of natural humus gave the following percentage results.

	C.	H.	N.	O.	Ash.
1. Rich prairie soil	45·12	3·67	10·37	28·60	12·24
2. Cultivated soil	48·16	5·40	9·12	33·16	4·16
3. Never cultivated	44·12	6·00	8·12	35·16	6·60
4. Cultivated (about 40 years)	50·10	4·80	6·54	33·66	4·90

N. H. J. M.

Physical Effects of Various Salts and Manure Constituents on a Soil as Modifying the Factors which Control its Supply of Moisture. By JASPER L. BEESON (*J. Amer. Chem. Soc.*, 1897, **19**, 620—649).—The rates of saturation and of percolation were determined without, and after addition of small amounts of salts (various potassium, sodium, calcium, magnesium, and ammonium salts). The rate of evaporation, and the rate and extent of capillary "lift" were also determined under the different conditions.

In general, it was found that the four principal factors on which the moisture of soil depends (the rates of saturation, percolation, evaporation, and capillary rise) when altered by adding some salt, all vary in the same direction, whilst the capillary effect as shown by height varies in the opposite direction. The action of certain salts (sodium carbonate, for instance) in reducing the rate of percolation, &c., is due to the breaking up of the soil aggregates into smaller ones, and *vice versâ*. At first sight, this seems opposed to the general experience that neutral salts precipitate fine clay when suspended in water, but in this case the soil particles have already been broken up, and only the finest are present.

Of the salts experimented with, those which most frequently occur in manures (potassium and ammonium sulphates and calcium superphosphate) would have very little effect on soil moisture when applied in the usual amounts, and their beneficial effect must be mainly due to the plant-food they contain. Sodium carbonate, chloride, and nitrate have, however, a much greater effect. These salts greatly decrease the rate of absorption of water, whilst they considerably increase the power of the soil in retaining moisture for the use of the crop; sodium nitrate is thus very suitable for soils which, at the same time, need nitrogen, and are not sufficiently retentive of moisture. More nitrogenous soil of a similar physical nature should be treated with sodium carbonate or chloride. Soil which is already too retentive would be injured by adding sodium nitrate to supply nitrogen. This explains why sodium nitrate often decreased the yield of sugarcane in Louisiana, whilst lime gave good results. N. H. J. M.

Proportions of Chlorine and of Nitrogen as Nitric Acid and as Ammonia in certain Tropical Rain-waters. By J. BURCHMERE HARRISON and JOHN WILLIAMS (*J. Amer. Chem. Soc.*, 1897, **19**, 1—9).—Analyses of the rain in Barbados and British Guiana, made for several years in succession, gave the following average results (lbs. per acre).

	Average rainfall, inches.	N. as ammonia.	N. as nitrates.	Total nitrogen.	Chlorine.
Barbados	59·40	1·009	2·443	3·452	62·46
Brit. Guiana...	106·71	1·321	2·190	3·511	108·61

The highest and lowest results obtained were as follows (parts per million).

	N. as ammonia.		N. as nitrates.		Chlorine.	
Barbados	1·812	0·0	0·914	0·001	47·04	2·48
Brit. Guiana...	1·376	0·0	0·823	0·0	16·10	0·45

The total nitrogen (as nitrates and ammonia) per acre in the two colonies, situated in the tropics and in the direct course of the trade winds, is rather less than at Rothamsted (3·74 lbs. per acre); the relative amounts of nitrogen as ammonia and as nitrates is, however, very different. At Rothamsted, the nitrogen as nitrates amounts to rather over one-fourth of the total. In Barbados about three-fourths of the nitrogen is present as nitrates, and in British Guiana about two-thirds of the nitrogen is in this form. Comparing the results with those obtained at Tokio and in New Zealand, it is concluded that in tropical rain a higher proportion of the nitrogen is present as nitrates than in the case of the rain of temperate climates. In rain-water from Venezuela and Réunion, the nitrogen as nitric acid was found to be 0·578 and 0·69 per million respectively (Müntz and Marcano, Abstr., 1889, 923).

It is concluded that, whilst the rain of the tropics is richer in nitric nitrogen than elsewhere, the total nitrogen supplied to the soil by the rain is not greater. N. H. J. M.

Analytical Chemistry.

Apparatus for Gas Analysis. By Theodor Pfeiffer and Otto Lemmermann (*Landw. Versuchs.-Stat.*, 1898, 50, 143—158).—The apparatus employed for collecting and measuring the gases in the experiments on denitrification (this vol., ii, 445) is described, with sketches. It is constructed on the principle of weighing the amount of mercury corresponding with the volume of gas, instead of measuring the gas. The apparatus is suitable for dealing with large amounts of gas, and could be readily modified according to requirements.

N. H. J. M.

Volumetric Estimation of Combined Sulphuric Acid. By Fernand Telle (*J. Pharm.*, 1898, [vi], 7, 165—170).—In the method described by the author, the sulphuric acid is precipitated by adding a known volume of standard barium chloride solution, and the excess of the latter by an excess of a standard solution of potassium dichromate, rendered alkaline by the addition of ammonia free from carbonate; the unprecipitated potassium chromate is then estimated by determining, by means of sodium thiosulphate, the amount of iodine it is capable of liberating from potassium iodide. The standard solutions used should be of equivalent concentrations; if the barium chloride is decinormal, the solution of potassium dichromate should contain 7·358 grams of the pure salt per litre, whilst the thiosulphate solution, standardised by means of the latter, should contain about 38 grams of the crystallised salt ($+5H_2O$) per litre.

To determine the sulphuric acid in a natural water, 500 c.c. of the latter is evaporated, after the addition of 4—5 c.c. of hydrochloric acid, until the volume is about 10 c.c., and is then decanted into a

110 c.c. flask, the residue being carefully washed with the least possible amount of water; 10 c.c., or a sufficient excess, of the barium chloride is added, the liquid boiled and rendered alkaline by ammonia, and 100 c.c. of the dichromate solution added. The solution is again boiled, then cooled and made up to 110 c.c., and filtered; to 100 c.c. of the filtrate, acidified with hydrochloric acid, 5 c.c. of 10 per cent. potassium iodide solution is added, and the liberated iodine estimated by the solution of thiosulphate, the end-reaction with starch solution being quite sharp. Allowance has, of course, to be made for the fact that 100 c.c. only of the original 110 c.c. containing free chromate was used for the titration. In the case of waters containing a large amount of organic matter, the latter has to be oxidised by potassium chlorate during the preliminary evaporation, when the volume is about 50 c.c., care being taken to expel completely the chlorine produced during this oxidation.

The potassium sulphate present in a wine-extract can be determined by a similar method; the results obtained are, however, slightly high, owing to the presence of traces of phosphoric acid in the extract.

W. A. D.

Simultaneous Volumetric Estimation of Sulphuric Acid and Calcium Salts in Water. By LUCIEN ROBIN (*J. Pharm.*, 1898, [vi], 7, 283—286).—To 100 c.c. of the water contained in a measuring flask with the neck widened above the graduation mark, 0·5—1·0 c.c. of a solution containing 100 grams of sodium carbonate and 50 grams of pure caustic soda dissolved in 300 c.c. of water is added, the mixture boiled during five minutes, and, after cooling, diluted to 100 c.c.; the precipitate is removed by filtration, and 50 c.c. of the filtrate taken for the determination of the sulphuric acid. This is carried out by neutralising with hydrochloric acid, boiling to expel carbonic anhydride, neutralising again with ammonia, and precipitating with an excess (10 c.c.) of half-decinormal barium chloride; after standing for 15 minutes, the solution is again boiled, and 10 c.c. added of a solution prepared by saturating with ammonia 3·69 grams of potassium dichromate dissolved in a litre of water. The liquid is then filtered, 20 c.c. of a solution containing 10 grams of ferrous sulphate per litre added, and the amount of the latter remaining unoxidised determined by standard potassium permanganate.

To estimate the calcium salts, the precipitate obtained from the original 100 c.c. of water is dissolved in hydrochloric acid, the solution rendered alkaline by ammonia, and 10 c.c. of decinormal ammonium oxalate added; after standing 30 minutes, the excess of ammonium oxalate can be determined in the filtrate by acidifying with nitric acid, and titrating against permanganate; or the calcium oxalate can be dissolved in dilute nitric acid, and the oxalic acid liberated determined by the same method.

W. A. D.

Detection and Estimation of Sulphurous and Thiosulphuric Acids. By WILHELM AUTENRIETH and A. WINDAUS (*Zeit. anal. Chem.*, 1898, **37**, 290—300).—For qualitative separation, use may be made of the wide difference in the solubility of the strontium salts of the above two acids. The sulphite requires 30,000 parts, the thiosulphate 3·7 parts of water for solution. A mixture of the alkali salts of the two acids is therefore treated with excess of strontium nitrate or chloride, shaken vigorously, filtered after a few minutes through a double filter, and the precipitate well washed. The thiosulphate in the filtrate is recognised by the precipitation of sulphur on decomposing with hydrochloric acid, the sulphite in the precipitate by dissolving in dilute acid and oxidising with iodine to sulphate, either with or without previous addition of barium chloride.

For quantitative estimation, a solution containing the two salts is titrated with iodine: a second portion of the same solution is mixed with excess of strontium nitrate, made up to a known volume, shaken, filtered after some hours through dry paper and an aliquot part of the filtrate titrated as before. By deducting 0·4 c.c. of N/10 iodine per 100 c.c. from the last titration to correct for the solubility of strontium sulphite, very fair results are obtained. M. J. S.

Detection of Nitric Acid in Human Remains. By ANTON SEYDA and R. WOY (*Chem. Centr.*, 1897, ii, 1036—1037; from *Zeit. öffentl. Chem.*, 3, 487—493).—If possible, the urine should be tested for nitrous acid by distilling it with dilute sulphuric acid, collecting the distillate in a flask containing aqueous soda, using Griess' well-known test. Another portion is then boiled with hydrochloric acid and ferrous chloride, and the gases passed into a separating funnel filled with mercury, and also containing a little aqueous soda. The mercury is afterwards displaced by means of a current of oxygen, and the alkaline solution again tested for nitrous acid; if the reaction is now very much stronger, it may be safely assumed that nitric acid was present.

Other portions of the body, finely comminuted, are twice macerated with water, and the liquid, filtered through cotton wool, is mixed with a slight excess of lime and evaporated to a syrupy consistence; this syrup is then extracted with alcohol to dissolve the calcium nitrate, and after evaporating the spirit, the residue is dissolved in a known volume of water and the solution used for the detection or estimation of the nitric acid. The method best suited for the estimation of the nitric acid is the well-known Schlösing-Schulze process. Methods based upon its conversion into ammonia cannot be employed, as it is impossible to free the liquid from ammonia by distillation with potash. L. DE K.

Detection of Phosphorus. By H. NATTERMANN and ALBERT HILGER (*Chem. Centr.*, 1897, ii, 981—982; from *Forsch. Ber. Lebensm. Hyg.*, 4, 241—258).—The authors have slightly modified Mitscherlich's apparatus. By means of a 30 cm. glass tube, furnished with india-rubber connections and a screw clamp, air is drawn through the apparatus until phosphorescence sets in, when a current of carbonic anhydride is substituted for the air, and the liquid in the flask is heated to boiling. Besides causing the phosphorescence to be more plainly visible, the process has the further advantage that more than 90 per cent. of the phosphorus may be recovered from the distillate.

They have also modified Dussard-Blondlot's method. A 100 c.c. wide-necked flask containing the supposed silver phosphide precipitate, and also some zinc and water, is closed by means of a cork perforated with three holes; through two of these pass rectangularly bent tubes which do not penetrate below the cork. A current of hydrogen generated from a Kipp's apparatus is passed in through one of them and out by the other, which is connected with a U-tube containing pumice-stone drenched with aqueous potash, this in turn being connected with a glass tube furnished with a platinum jet. The third opening is fitted with a safety funnel. After the hydrogen flame has been carefully tested and found to be free from any green colour, dilute sulphuric acid (1 : 5) is admitted through the safety-funnel, and this, if phosphorus be present, will cause the liberation of hydrogen phosphide from the silver phosphide, and the flame will become greenish. L. DE K.

Rapid Estimation of Phosphorus. By HENRYK WDOWISZEWSKI (*Chem. Centr.*, 1897, ii, 1038; from *Stahl. u. Eisen*, 1897, 814—815).—Two grams of pig iron dissolved in 30 c.c. of nitric acid of sp. gr. = 1·2 is diluted to 50 c.c. with water, filtered from the undissolved silicic acid and graphite, and boiled down to the original bulk; it is then oxidised with potassium permanganate, mixed with hydrochloric acid, and, when cold, neutralised with ammonia. After heating to 60°, molybdate solution is added, the whole shaken for 5 minutes and the yellow precipitate collected and washed with a 10 per cent solution of ammonium nitrate. It is then dissolved in ammonia, and after partly neutralising with hydrochloric acid, a few c.c. of magnesia mixture and an excess of ammonia are added. The closed flask is then allowed to stand for 15 minutes in ice, shaken for 5 minutes, and the precipitate at once collected on a filter. After being washed with dilute ammonia, it is dried, ignited, and weighed. L. DE K.

Estimation of Phosphoric Acid as Phosphomolybdic Anhydride. By P. NEUMANN (*Zeit. anal. Chem.*, 1898, **37**, 303—308).—From the experiments of Woy (this vol., ii, 138), it appears that the large excess of ammonium molybdate commonly employed is not necessary; 20 per cent. above the theoretical amount for the production of $24MoO_3,P_2O_5$, or about 36 parts for one part of P_2O_5, being sufficient. In the analysis of ferruginous phosphates (basic slag), Woy's method gives somewhat lower results than the ordinary process, in which the phosphoric acid is finally precipitated as ammonium magnesium phosphate. This deficiency seems to be attributable to the presence (in the yellow precipitate) of iron phosphate, the molecular weight of which is much lower than that of the molybdenum compound. By employing the following process, results have been obtained agreeing very closely with those in which the precipitate was weighed as magnesium pyrophosphate.

Fifty c.c. of the cold phosphate solution (containing about 0·5 gram of substance) is nearly neutralised with ammonia, then mixed with 120 c.c. of the ordinary molybdate solution, and stirred in the cold for 15 minutes. The precipitate is then washed three times by decantation with a solution containing 5 per cent. of ammonium nitrate and 1 per cent. of nitric acid, and rinsed into a Gooch crucible with the same liquid. The Gooch crucible, placed inside an ordinary porcelain crucible, is exposed to a gradually rising temperature for about 25 minutes, during the last 15 of which the flame of the Bunsen burner completely surrounds it. The bluish-black residue has the formula $24MoO_3,P_2O_5$.

M. J. S.

Ignition of Ammonium Magnesium Phosphate. By Max Schmoeger (*Zeit. anal. Chem.*, 1898, **37**, 308—310).—In igniting the precipitate obtained in a phosphoric acid estimation, it is customary to detach it from the filter as completely as possible, burn the latter in a coil of platinum wire, and raise the temperature of the crucible containing the precipitate very gradually. These precautions are quite unnecessary. After shaking out most of the precipitate into the crucible, the paper filter may be folded together and added to the precipitate. The cover is then placed on the crucible and the latter at once exposed to the full flame of a Bunsen burner; a little later, it is placed obliquely, and is finally heated with the blow-pipe flame. A white pyrophosphate is quickly and easily obtained; the weight agrees accurately with that resulting from the most cautious ignition, and no action on the platinum crucible is perceptible. M. J. S.

Colorimetric Estimation of Silica in Water. By Adolf Jolles and Friedrich Neurath (*Zeit. angw. Chem.*, 1898, 315—316).—The process is based upon the yellow coloration noticed when solutions of silicic acid are heated with a nitric acid solution of molybdic acid. Eight grams of potassium molybdate is dissolved in 50 c.c. of water and poured into 50 c.c. of nitric acid of sp. gr. = 1·2. Twenty c.c. of the sample of water is put into a test-tube of such size that the column of liquid will be about 18 cm. high; 1 c.c. of the molybdate solution is then added. Similar tubes are taken containing distilled water, with varying small quantities of silicic acid in the form of an alkali silicate, and to each, 1 c.c. of the reagent is added. On warming to 80°, the colour will make its appearance, and the tubes are then compared as usual. The amount of phosphoric acid in waters that have not been concentrated is so small that it does not interfere with the reaction. L. de K.

Alkalimetric Estimation of Metals. By Henri Lescœur (*Bull. Soc. Chim.*, 1897, [iii], **17**, 26—55).—The volumetric estimation of metals forming oxides soluble in water presents no special difficulty, and the nature of the indicator employed is immaterial. In the case of metals forming insoluble oxides, however, litmus cannot be used, owing to the formation of unstable compounds of the oxide with the indicator, and there is an important distinction between the results obtained by the use of helianthin, on the one hand, and phenolphthalein on the other. When alkali is gradually added to a liquid containing an insoluble oxide and excess of acid in presence of phenolphthalein, the red coloration of the latter does not make its appearance until the free acid has been neutralised and the whole of the oxide precipitated. Phenophthalein, therefore, is an indicator of the transition from neutrality to alkalinity. Helianthin, on the other hand, indicates the passage from acidity to neutrality, the end point being reached when the free acid has been neutralised, and the precipitation of the oxide is about to commence. If both indicators are present in the solution, the amount of alkali added between the two end points is proportional to the metallic oxide present. An insoluble base may be titrated directly by means of standard acid and helianthin, but as solution takes place slowly, it is generally advantageous to dissolve in a known excess of acid and titrate back with alkali. A similar procedure is sometimes required when phenolphthalein is employed, especially when there is a tendency to the formation of basic salts, or when the insoluble oxide is coloured; in this case, the solution is boiled with excess of alkali, filtered, and the filtrate titrated back with standard acid.

The accuracy of the results obtained by the use of phenolphthalein is liable to be adversely affected by the presence of carbonic anhydride, and the carrying down of undecomposed salt by the precipitated oxide. These sources of error are to be avoided by working with sufficiently dilute solutions, free from carbonic anhydride, and by operating at the boiling temperature. It is also to be noted that some oxides, such as those of magnesium, silver, and lead, usually regarded as insoluble in water, are sufficiently soluble to affect phenolphthalein. The indications of helianthin are not so sharp as those of phenolphthalein, and are very obscure in the presence of feeble acids and of ferric oxide; for this reason, oxalic acid is not so well adapted for alkalinity as the mineral acids. The standard alkali should be free from carbonate and alumina or other oxides. The use of baryta offers certain advantages, its strength undergoes alteration from absorption of carbonic anhydride, but remains independent of the nature of the indicator. Barytes is not sufficiently soluble to allow of a normal solution being obtained, but a mixture of baryta and soda answers equally well. The use of picric acid is recommended for standardising the solutions, as it is easily obtained pure and has a high molecular weight, 229. The chief disadvantage attending its use is its sparing solubility, 400 c.c. of water being required for the solution of 2·29 grams. In the comparison of the standard acid and alkali with each other, the intervals between the end points indicated by phenolphthalein and helianthin should not correspond with more than one or two drops of N/10 solution. The absence of appreciable amounts of carbonic anhydride or alumina is thus proved.

Estimation of Magnesium.—As magnesium oxide is sufficiently soluble to affect phenolphthalein, magnesia, obtained by precipitation with sodium hydroxide and subsequent washing with water, may be titrated directly by using phenolphthalein and adding standard acid until the red colour is discharged; but as the oxide dissolves slowly, it is better to boil the precipitated magnesia, or magnesium carbonate, with excess of standard acid and titrate back with alkali. If other metals are present along with magnesium, phenolphthalein is added to the solution, and then alkali until the red colour appears. The precipitated oxides are filtered off, and the magnesia, which is left in solution, is precipitated by further addition of alkali, and estimated as before.

Magnesia is best separated from alumina by boiling with excess of caustic soda, whilst lime must be removed by means of ammonium carbonate, since it is partially precipitated along with magnesia by caustic soda.

Estimation of Zinc.—[With CL. LEMAIRE.]—The results obtained by previous observers are criticised, and the following methods are stated to give the most satisfactory results. (1) The solution is boiled with excess of sodium carbonate, filtered, and the washed precipitate, together with the filter, treated with excess of standard acid and titrated back with alkali, using helianthin as the indicator. (2) Both indicators are added, and then standard alkali until the red tint of the helianthin disappears. Excess of alkali is now added, the solution boiled, and titrated back with acid until the end point indicated by phenolphthalein is reached. The alkali used between the two end points corresponds with the zinc present. Instead of weighing the oxide or sulphide of zinc obtained in the usual gravimetric processes, it is recommended that the moist precipitates be dissolved in hydrochloric acid, boiled, and treated by method 2; the error arising from the presence of alkali in an imperfectly washed precipitate is thus avoided.

Estimation of Lead.—[With DELSAUX].—The direct titration of lead salts with caustic alkalis is unsatisfactory, owing to combination taking place between the phenolphthalein and oxide of lead. Good results, however, are obtained by using sodium carbonate at the boiling temperature. Helianthin may also be used, the lead being precipitated as oxide or carbonate, washed, dissolved in excess of acid, and titrated back with alkali. If free acid be present, sodium carbonate is run in until the red tint of helianthin is discharged; the solution is boiled, and the titration continued to the end point indicated by phenolphthalein. Lead sulphate may be titrated in precisely the same manner, although the reaction takes place somewhat slowly, and this process is useful in connection with the separation of lead from other metals. In the presence of the alkaline earths, the sulphates of which are also insoluble, the lead is to be precipitated by caustic alkali added in very slight excess, and the washed precipitate treated as above described. N. L.

Estimation of Potash in Potash-manures. By LÉON RONNET (*Chem. Centr.*, 1897, ii, 1157—1158; from *Rev. Chim. anal. applic.*, 5, 421—422).—*Assay of Potassium Chloride.*—Fifty grams of the sample is dissolved, made up to 1 litre, and filtered; 20 c.c. of the filtrate is mixed with 10 c.c. of saturated baryta water and the excess of barium is then removed by a current of carbonic anhydride. After boiling for a few minutes, the liquid is filtered and the potash is then estimated in the usual way with perchloric acid.

Assay of Potassium Sulphate and Kainite.—Instead of 10 c.c. of baryta water, 40 c.c. is used, and the operation is conducted as before.

Assay of mixed Manures.—Twenty-five grams of the manure is dissolved, made up to 500 c.c. and filtered. 100—200 c.c. of the liquid is dried in a porcelain dish with 1—2 grams of calcium hydroxide, incinerated at the lowest possible temperature, the residue dissolved in boiling water, and the filtrate, which is kept boiling, is then treated with baryta as described. L. DE K.

Detection of Sodium Carbonate in Sodium Phosphate. By GEISSLER (*Zeit. anal. Chem.*, 1898, **37**, 323; from *Pharm. Centralh.*, **34**, 729).—Phenolphthalein will detect 1/10 per cent. of sodium carbonate in disodium hydrogen phosphate, which latter, when pure, gives no pink colour with the indicator. The test with ammonium chloride and magnesium sulphate, sometimes recommended, is fallacious.

M. J. S.

Analysis of Sodium Sulphide. By FERDINAND JEAN (*J. Pharm.*, 1898, [vi], **7**, 170—172).—Ten grams of the coarsely powdered sample is dissolved in water, and, after removing the insoluble substances by filtration, diluted to a litre. The quantity of iodine corresponding with the sodium sulphide, polysulphides, and thiosulphate in 10 c.c. of the solution is then determined by direct titration. The sodium monosulphide present in the 10 c.c. is estimated by adding as many c.c. of a solution containing 6·7 grams of ammonium sulphate per litre as were employed in the iodine titration, diluting with 30 c.c. of water, and distilling the ammonia liberated into 20 c.c. of decinormal acid; the distillate is then boiled to expel hydrogen sulphide, and the excess of acid determined. Each cubic centimetre of acid neutralised by the ammonia corresponds with 0·0039 gram Na_2S. The residue in the distilling flask is then titrated against decinormal iodine, and the quantity of sodium thiosulphate in the original 10 c.c. determined. The difference between the first and second iodine titrations is a measure of both the monosulphide and polysulphides present, and is best expressed in terms of the former. The value so obtained is always greater, unless no polysulphides are present, than that obtained for the monosulphide by the ammonia distillation, since the latter only determines monosulphide present as such. The difference between the two values indicates an excess of monosulphide corresponding with the polysulphides, so that it is best expressed as sulphur. Since both the monosulphide and polysulphides of sodium behave in the same way towards ammoniacal zinc solution, the same results are obtained by titration against the latter as were obtained with iodine.

W. A. D.

Microchemical Detection of Magnesia. By GYSBERT ROMIJN (*Zeit. anal. Chem.*, 1898, **37**, 300—301).—Traces of magnesium may be detected in presence of cobalt, iron, chromium, aluminium, and the alkali metals, by adding a little citric acid, and excess of ammonia, evaporating to dryness without regard to any precipitate which may form, dissolving the residue in ammonia (diluted with 10 volumes of water), and adding a fragment of sodium phosphate. The crystals obtained at any dilution exhibit under the microscope the hemimorphic forms described by Behrens, together with a highly characteristic twin combination, of which a figure is given. The presence of much zinc is an obstacle to the microchemical detection of magnesia.

M. J. S.

Electrolytic Estimation of Cadmium. By EBERHARD RIMBACH (*Zeit. anal. Chem.*, 1898, **37**, 284—290).—The author reports his experience of the cyanide method of Beilstein and Jawein (Abstr., 1879, 746) which he pronounces to be a perfectly satisfactory one. The cadmium may be in the form of either chloride or sulphate; the neutral solution is to be treated with an excess (about 3 grams) of 98 per cent. potassium cyanide and electrolysed at ordinary temperatures with a current of 0·02—0·04 ampère and a potential of 3—3·3 volts, which may either be supplied from a storage battery or from 3—5 Meidinger elements. In 12—16 hours, quantities of metal up to 0·4 gram can be deposited, and in all cases the metal is deposited in a coherent and lustrous layer, no trace of spongy metal ever being obtained. That the current is strong enough may be judged from the solution acquiring a dark brown colour; but too strong a current leads to the deposition of black stains, whilst the platinum cathode is slightly attacked. Should copper be present, that metal is not precipitated until all the cyanide is decomposed. In this case, 5 grams of cyanide should be added, and a very satisfactory estimation of both metals can be made. Should the metals be present as nitrates, conversion into chlorides is desirable. In presence of magnesium, addition of ammonium chloride prevents the deposition of any of that metal. M. J. S.

Estimation of Traces of Lead in Sugar and Saccharine Liquors. By ALEXANDER KOLLREPP (*Chem. Centr.*, 1897, ii, 1160; from *N. Zeit. Rüb. Zuck. Ind.*, **38**, 126—128).—If hydrogen sulphide is passed through a saccharine liquid containing a trace of lead, the lead sulphide is so finely divided that it cannot be filtered off, but it may be precipitated by adding to the liquid a mixture of paper pulp and aluminium hydroxide. The author now proposes using white of egg; 500—1000 grams of sugar is dissolved in water to 30—40° Brix, and after passing hydrogen sulphide for half an hour and allowing the liquid to remain for another 3 hours, solution of white of egg is added, and the whole boiled; if the liquid is alkaline, it must be previously neutralised with acetic acid. The precipitate is collected, washed with a weak solution of hydrogen sulphide, dried, and incinerated; the ash is then moistened with water, a little sodium carbonate added, and the whole gently ignited; by treating the residue repeatedly with water, any sulphuric acid is removed, and the undissolved portion together with the filter is again ignited, and then digested for half an hour with boiling concentrated nitric acid. After diluting and filtering, the liquid is evaporated nearly to dryness, the residue extracted with water, and the lead tested for with hydrogen sulphide.

The amount of lead found by the author in juices which had been treated by Wohl's lead oxide process was quite insignificant.

L. DE K.

Detection and Estimation of Traces of Lead in Beet Sugar. By GEORG KASSNER (*Chem. Centr.*, 1897, ii, 1160—1161; from *Dingl. Pol. J.*, 298, 303).—The author states that traces of lead in beet sugar may be detected and estimated by Kollrepp's process (see preceding abstract). L. DE K.

Volumetric Estimation of Chromium. By RUDOLF L. LEFFLER (*Chem. News*, 1898, 77, 156—157).—Galbraith's method of estimating chromium in steel or iron by dissolving the metal in dilute sulphuric acid, oxidising the ferrous sulphate formed with potassium permanganate and the chromic oxide by the further use of an equal quantity of the same reagent, filtering, adding ferrous salt to the filtrate, and titrating back with potassium dichromate, is shown to give results varying with the proportion of acid used for solution, and also with the magnitude of the excess of permanganate employed. It is necessary to make a blank experiment under exactly the same conditions as those used in the analysis, and to subtract the value so obtained from the amount of chromium found. D. A. L.

Separations from Chromic Acid. III. Separation of Aluminium. By HARRY BREARLEY (*Chem. News*, 1898, 77, 179—180. Compare this vol., ii, 409).—With potassium chromate and aluminium chloride in hot solutions, the author finds, as other workers have done, that no permanent precipitate forms until five equivalents of chromate have been added; with cold solutions, however, even a small amount of chromate gives a precipitate which only dissolves tardily and never completely; with iron, the reverse is the case (compare *loc. cit.*). Aluminium hydroxide reacts with potassium chromate, therefore the separation of chromium and aluminium is imperfect unless alkali is used in excess. The recovery of chromium from solutions containing 0·5 gram of aluminium and 50 c.c. of potassium chromate (1 c.c. = 0·05 Fe) amounted to 99 per cent. with an excess of 30 c.c. of 2N sodium carbonate, but was less with smaller excess of this alkali, or when ammonia or ammonium carbonate was used. For aluminium estimations, however, it is pointed out that the quantity of aluminium hydroxide dissolved is greater the greater the excess of alkali, and that sodium carbonate is more active in this direction than the other alkalis. The separation of chromium from aluminium by means of sodium acetate is imperfect, since, when neutralised not only is there an error due to the reaction of the chromate with aluminium chloride, but also that due to the reaction between the latter and the aluminium hydroxide, whereas, when not neutralised, much aluminium is dissolved. With sodium phosphate, however, following Carnot's instructions, or even in neutralised solutions, the separation is satisfactory; but 20 c.c. of saturated sodium phosphate is not sufficient to precipitate 0·5 gram of aluminium; therefore to separate chromium and aluminium, the use of ammonia or ammonium carbonate or of any method involving the precipitation of aluminium from a neutral solution should be justified or abandoned. From what has been shown, it is evident that the separation of alumina and ferric oxide together from chromic anhydride cannot be effected by sodium carbonate, sodium hydroxide, or sodium phosphate without modifications of the present methods; the sodium phosphate separation becomes effective by treating the solution so as to just neutralise the free acid without the formation of any dissolved ferric hydroxide, a state indicated by the change of colour; under these conditions, and with 0, 2, and 5 per cent. of acetic acid, nearly perfect chromium recoveries were obtained from mixtures of equivalent proportions of ferric chloride and potassium chromate. D. A. L.

Volumetric Estimation of Metallic Sulphides. By Jos. Hanus (*Zeit. anorg. Chem.*, 1898, **17**, 111—116).—The method consists in treating the precipitated sulphide with ferric sulphate or chloride, and titrating the ferrous solution so obtained with permanganate.

In the estimation of antimony, the reaction takes place according to the equation $Sb_2S_3 + 5Fe_2(SO_4)_3 + 8H_2O = 2H_3SbO_4 + 10FeSO_4 + 5H_2SO_4 + S_3$. From 0·2—0·9 gram of antimony sulphide is boiled for 15 minutes with an excess of ferric sulphate, and, after cooling, sufficient sulphuric acid added to dissolve the precipitate and the solution made up to 200 c.c.; 100 c.c. is then filtered through a dry filter, and titrated with permanganate. The results are accurate. The antimony, in mixtures of antimony sulphide and sulphur, can be estimated by this method, as the sulphur has no influence on the result. It is important that the antimony sulphide precipitate should not be exposed to the air, as ferric sulphate is without action on the oxysulphide.

Ferric sulphate also reacts with the sulphides of lead, mercury, copper, cadmium, tin, arsenic, and bismuth. The author has obtained accurate results by this method with lead and bismuth sulphides. Mercury and arsenic sulphides are only partially oxidised, even after prolonged action. With copper sulphide, the author could not obtain accurate results with ferric sulphate, and with ferric chloride 99 per cent. of the copper was determined, but the blue colour of the solution greatly interferes with the titration. E. C. R.

New Method of Estimating Bismuth. By Ludwig Vanino and F. Treubert (*Ber.*, 1898, **31**, 1303).—Formalin (formaldehyde solution) and a large excess of soda are added to the slightly acid bismuth solution, and the whole is heated on the water bath and stirred until the liquid has become clear, after which a little more formalin and alkali is added, and the heating is continued for a few minutes over a bare flame. The spongy precipitate of metallic bismuth is washed repeatedly by decantation, pressed together with a glass rod, collected on a tared filter, washed with absolute alcohol, dried at 105°, and weighed. The method is simpler than the usual ones, and quite as accurate; in the analyses quoted, the maximum error is ± 0·1 per cent. of the weight of the bismuth. C. F. B.

Estimation of Methane in Fire-damp. By Eduard Hankus (*Chem. Centr.*, 1897, ii, 987; from *Österr. Zeit. Berg. Hütt.*, **45**, 548—549).—The sample should be collected in a glass, and not in a tin, vessel, as when the latter is used it is not possible to see whether any deposit is formed on the sides of the vessel. If there is such a deposit, it may cause the complete absorption of the methane, but if there is none, the gas may be kept for some 18 days without undergoing any diminution in volume. Excess of methane will always be noticed after a sudden fall of the barometer. L. de K.

Estimation of Ferrocyanogen. By Leonard de Koningh (*Zeit. angw. Chem.*, 1898, 463—464).—The process is based on the fact that the insoluble ferrocyanides are decomposed by heating with aqueous potash, yielding potassium ferrocyanide. The latter, when fused with saltpetre, yields ferric oxide, which may be estimated with great accuracy, and the amount of ferrocyanogen calculated from it. If the sample contains Prussian blue, it is likely to contain also lead chromate; this also dissolves in the potash, but the lead may be removed by means of sodium sulphide, the chromium passing all but completely into the melt. The undissolved ferric oxide must not be weighed without further purification, which is best effected by dissolving it in hydrochloric acid, adding citric acid, and finally ammonia and ammonium sulphide. The iron sulphide is then converted into oxide by ignition.

The author points out the difficulty experienced when testing commercial Prussian blue. If it contains much alumina, it is impossible to state with certainty whether part of the "ferrocyanogen" found is not really the valueless aluminium compound. Then, again, even the most carefully prepared blue is a mixture of the real ferric ferrocyanide with ferric hydroxide and alkali ferrocyanide. An experiment is described from which it would appear that 1 part of ferric oxide corresponds with about 5 parts of commercial Prussian blue. L. de K.

Volumetric Estimation of Glycerophosphates. By A. Astruc (*J. Pharm.*, 1898, [vi], 7, 5—8).—Although solutions of calcium glycerophosphate are always alkaline to methyl-orange, they are sometimes acid and sometimes alkaline towards phenolphthalein; in the latter case, the alkalinity is very feeble, whereas, when acid, a considerable quantity of caustic soda is required for neutralisation. When either the acid or alkaline salts have been exactly neutralised in presence of phenolphthalein, the amount of sulphuric acid subsequently required to produce a neutral tint with methyl-orange corresponds with the equation $2Ca(C_3H_7O_2)PO_4 + H_2SO_4 = CaSO_4 + CaH_2(C_3H_7O_2PO_4)_2$. When the solution of the glycerophospate has, in the first place, been rendered neutral to methyl-orange by a mineral acid, the amount of caustic soda required to produce a pink coloration with phenolphthalein corresponds with the equation $CaH_2(C_3H_7O_2PO_4)_2 + 2NaOH = CaNa_2(C_3H_7O_2PO_4)_2 + 2H_2O$, or $= Ca(C_3H_7O_2)PO_4 + Na_2(C_3H_7O_2)PO_4 + 2H_2O$.

In either of the above cases, 2 molecules of sodium hydroxide correspond with 1 molecule of phosphoric anhydride. By using the second reaction, the author finds that the amount of the latter present in samples of calcium glycerophosphate can be determined with a fair degree of accuracy, providing, of course, that the salt is not adulterated with other metallic phosphates or phosphoric acid. W. A. D.

Volumetric Estimation of Glycerophosphates. By Adrian and Auguste Trillat (*J. Pharm.*, 1898, [iv], 7, 163—165, and 225—226. Compare preceding abstract, and this vol., i, 222).—The authors describe a method for estimating glycerophosphates of the alkaline-earths, which is substantially identical with that depending on the first equation in the preceding abstract.

The presence of glycerol does not interfere with the use of methyl-orange or phenolphthalein as indicators for estimating phosphoric acid by titration against alkalis. When phosphoric acid is mixed with normal or acid glycerophosphates, the amount of alkali required for neutralisation corresponds, when either methyl-orange or phenolphthalein is used as an indicator, with the sum of the quantities required by the constituents of the mixture. W. A. D.

Estimation of Glucose in Urine by Means of Methylene-blue. By Goff (*Chem. Centr.*, 1897, ii, 1062; from *Rép. de. Pharm.*, 1897, 250).—Although urine decolorises methylene-blue, it has no such action if it has been previously strongly diluted. Urine may, therefore, be tested for glucose by adding to 1 c.c. of the diluted sample (1 : 3) 5 c.c. of a solution of methylene-blue (1 : 5000) containing a few drops of aqueous potash. Normal urine remains blue, but diabetic urine is at once decolorised or turns pale yellow. To render this reaction quantitative, 30 c.c. of methylene-blue solution mixed with 1 c.c. of 4·5 per cent. aqueous potash is added drop by drop to 1 c.c. of diluted urine, covered with a little xylene, and placed in boiling water until there is a permanent blue coloration. The xylene serves to protect the solution from atmospheric oxygen. The sample of urine should not contain more than 0·3 per cent. of glucose. One c.c. of a 0·1 per cent. solution of glucose requires 6·5 c.c. of the reagent. Urea, uric acid, sodium chloride, creatinine, peptones, albumin, do not reduce the blue; bilary matters turn it green. L. de K.

[Analysis of Sugar-cane Juice.] By C. H. Pellet (*Bied. Centr.*, 1898, **27**, 357).—See this vol., ii, 447.

Detection and Estimation of Starch in Opium. By Lyman F. Kebler and Ch. H. Lawall (*Chem. Centr.*, 1897, ii, 985; from *Amer. J. Pharm.*, 1897, 234).—Ten grams of opium is extracted with cold water, and then heated on the water bath with some alcoholic potash; the liquid is filtered hot, and after being freed from alcohol by evaporation, is acidified with hydrochloric acid, the whole boiled in a reflux apparatus for 3 hours. It is then neutralised with aqueous soda, made up to a definite bulk, and an aliquot part treated with Fehling's solution, either gravimetrically or volumetrically. It should be noted, however, that pentoses and other carbohydrates also yield glucose.

L. de K.

Estimation of Dry Matter in Beer and Worts, and the Relation of Dry Matter to Specific Gravity. By C. N. Riiber (*Bied. Centr.*, 1898, **27**, 336—339; from *Christiania Videnshaks selskabs Skr. I. Math.-Naturw. Klasse*, 1897, No. 5, 1—82).—The substance is dried under diminished pressure in a current of dry air. When heated for 1½ hours at 100° under 20 mm. pressure the error is at most 0·02 per cent. Very exact results are obtained by heating for 2 days at 80°; the error does not then exceed 0·005 per cent.

When there is a certain quotient between the amounts of dry matter of two solutions of the same sp. gr., the same quotients are found whatever the sp. gr. is; so that it is possible to construct a table for any beer extract, &c., by means of a single fundamental formula. A formula can then be obtained representing the relation between the sp. gr. and the amount of extract in the solution. As this relation varies according to the chemical composition and the mode of preparation of the worts and extracts, special formulæ must be calculated for exact determinations of extract by means of the sp. gr. The differences in the various groups (worts, (1) boiled, (2) not boiled, (3) partly fermented, and (4) completely fermented) are, however, so slight that, for practical purposes, a single table may be used. A table was made showing every sp. gr. between 1·0000 and 1·0859 for boiled worts, and the amount of extract shown by it never differed from the actual amount by more than 0·01 per cent. The formula in this case is $S = 1 + 0{\cdot}0039921e + 0{\cdot}000015136e^2$, in which S is the sp. gr. and e the amount of extract per cent. N. H. J. M.

Estimation of Aldehydes in Spirit by Means of Phenols. By E. Barbet (*Chem. Centr.*, 1897, ii, 1163; from *Bull. Assoc. des Chim. Sucre et Distill.*, 14, 943).—A few c.c. of a phenol, or a phenolic compound, is put into a test-tube and 2 c.c. of the spirit to be examined is added. After the phenol has dissolved, 1 c.c. of pure sulphuric acid is carefully run down the side of the tube and allowed to collect at the bottom; if aldehydes are present, coloration will be produced where the two layers meet. The tube is then shaken to mix the liquids, and a coloration is noticed depending on the nature of the reagent and the aldehyde, and, as regards its intensity, on the quantity of the latter. The colour produced by phenol and acraldehyde is a beautiful heliotrope; if resorcinol or thymol is used, a pale blue ring is obtained, with pyrogallol a violet wine-red, and with phloroglucinol an intense red is noticed. Formaldehyde is detected by means of gallic acid. Certain phenols give almost the same colours with the different aldehydes, for example, naphthol, quinol, and phloroglucinol; these reagents may therefore be used for the colorimetric estimation of the joint aldehydes. The author has, as yet, only checked the method with pure acetaldehyde and acraldehyde.

The detection of the nature of the aldehyde is important, as it gives a clue to the probable origin of a sample of spirit. L. de K.

Estimation of the Acidity of Beer or other Liquids containing Acid Phosphates. By Adolf Ott (*Chem. Centr.*, 1897, ii, 1121 and 1200; from *Zeit. ges. Brauw.*, 20, 540—543, 549—552, 572—573).—The author states that the acidity of some German beers is to a large extent due to the presence of acid phosphates; to estimate the acidity, the sample is deprived of its carbonic anhydride by means of a strong current of purified air (not by heating at 40—50°), and normal alkali is run in until the sample is neutral to red litmus paper; this will show if there is much free acidity. More alkali is then added until the liquid is neutral to blue litmus paper, which will indicate whether there is much acid phosphate. The free (acetic) acid may be estimated by distilling the sample in a current of steam and estimating the acidity in the distillate by decinormal alkali. The investigation will be continued. L. DE K.

Estimation of Tartaric Acid. By L. BRIAND (*Chem. Centr.*, 1897, ii, 919; from *Ann. de Chim. applic.*, 1897, 321).—Fifty c.c. of the filtered wine is mixed with an excess of pure potassium sulphate, well stirred, and after remaining for 2 days in a cool place the liquid is filtered, and the deposit washed with dilute alcohol previously saturated with potassium sulphate and potassium hydrogen tartrate. The estimation is then conducted in the manner directed by Magnier de la Source. The result obtained is corrected by adding 0·35 gram to the weight of the potassium hydrogen tartrate. The process gives, of course, not only the combined, but also the free tartaric acid. L. DE K.

Analysis of Crude Wine Lees and Argol (*Zeit. anal. Chem.*, 1898, **37**, 312—313).—The following mode of procedure, which is employed at the chemical factory "late Goldenberg, Geromont & Co." is recommended; to obtain accurate results it must be followed exactly. Six grams of the finely powdered lees is digested in the cold for 2 hours with 9 c.c. of hydrochloric acid of sp. gr. = 1·1. The mixture is then made up to 100 c.c., vigorously shaken and filtered; 50 c.c. of the filtrate is mixed with 18 c.c. of potassium carbonate solution containing 3·6 grams of the salt, and boiled for 10 minutes; the liquid is then filtered through a suction filter, the insoluble matter washed with boiling water until neutral, and the filtrate evaporated to about 15 c.c., mixed, after cooling, with 3 c.c. of glacial acetic acid, and stirred for 5 minutes. There is now added 100 c.c. of 95 per cent. alcohol, and the mixture is stirred again for 5 minutes, or until the precipitate has become granular. This is now collected on a suction filter and washed with alcohol until free from acid. The precipitate with the filter is thrown into a beaker, into which also the basin is rinsed with 100—120 c.c. of hot water, and is titrated by N/2 potash. For $(20+n)$ per cent. of tartaric acid thus found $[(20+n)-(0\cdot7+0\cdot02n)]$ per cent. is the true result.

In analysing argol and calcium tartrate, only 3 grams is employed, and the mixture with the hydrochloric acid is made up to 100·5 c.c., 50 c.c. of the filtrate being then treated as above. No correction is applied in these cases. M. J. S.

Hopkin's Method of Estimating Uric Acid. By OTTO FOLIN (*Zeit. physiol. Chem.*, 1898, **25**, 64).—Polemical; a reply to Ritter (this vol., ii, 358). W. D. H.

Detection of Small Quantities of Cotton-oil in Olive-oil and other Edible Oils. By MASSIMO TORTELLI and R. RUGGERI (*Zeit. angw. Chem.*, 1898, 464—466; and *Gazzetta*, **28**, i, 310—321).—The process is based upon the reducing action of cotton-oil on alcoholic silver nitrate, but, instead of applying the test to the original sample, it is applied to the liquid fatty acids obtained by the lead-ether process.

The fatty acids obtained from 5 grams of the sample are thoroughly freed from ether, and then dissolved in 10 c.c. of alcohol containing

1 c.c. of a 5 per cent solution of silver nitrate; the mixture is heated in a water bath to 70—80°, when the presence of cotton-oil is indicated by a more or less pronounced reddish-brown coloration, or even a black deposit. With care, as little as 1 per cent. of adulteration may be detected. L. DE K.

Analysis of Fats and Resins. By KARL DIETERICH (*Zeit. angw. Chem.*, 1898, 316—318; 434—435).—A controversy with Fahrion on the subject of the analysis of resins and of fats by the fractional saponification process, as to which the author claims priority, and as to the estimation of the acidity figure of fats and resins.

The author estimates this by first adding an excess of standard alkali, and titrating this back with standard acid. The process has nothing in common with Henriques' cold saponification method.

L. DE K.

Analysis of Fats and Resins. By WILHELM FAHRION (*Zeit. angw. Chem.*, 1898, 383—385, 527).—Replies to Dieterich (see preceding abstract). The author was not acquainted with Dieterich's work on the subject of resins. The fractional saponification process was only referred to briefly at the end of the author's paper.

In the second paper, the author replies to Dieterich's second article, and states that his object was to see how far the saponification and similar figures of fats are influenced by the presence of resins.

L. DE K.

Hübl's Iodine Addition Process. By J. J. A. WIJS (*Zeit. angw. Chem.*, 1898, 291—297).—The paper contains an exhaustive investigation into the true nature of the Hübl solution. The author has arrived at the conclusion that when alcoholic solutions of iodine and mercuric chloride are mixed, the liquid contains both mercuric iodide and iodine monochloride; the latter acts on the water, which is always present, forming both hydrochloric and hypoiodic acids. On keeping the solution, the latter acid acts on the alcohol, forming iodine, aldehyde and water.

If the freshly prepared solution is brought into contact with oleic acid, the free acids contained in it so react on the oleic acid as to form water and the chloriodine additive product; this, however, again loses a part of the chlorine as hydrochloric acid. L. DE K.

Analysis of Soaps. By HURST (*Chem. Centr.*, 1897, ii, 813—814; *Rev. Intern. Falsif.*, 10, 134).—Five grams of the soap is dried at 100°, reweighed, and then treated with light petroleum to dissolve unsaponified fat and free fatty acids; the residue is exhausted with alcohol, the alcoholic solution coloured with phenolphthalein, and any free alkali titrated with normal acid. After diluting with water and expelling the alcohol, the combined alkali is titrated with normal acid in the presence of methyl-orange. The fatty acids are then liberated by boiling with excess of hydrochloric acid, and after drying and weighing they are treated for rosin by Gladding's process. Any glycerol may be recovered by neutralising the acid filtrate with soda, evaporating to dryness, and extracting with absolute alcohol; the alcoholic extract is evaporated and the glycerol weighed.

L. DE K.

Analysis of Beeswax. By ROBERT HENRIQUES (*Chem. Centr.*, 1897, ii, 647—648; from *Zeit. öffentl. Chem.*, 3, 274—276).—The process is a slight modification of Weinwurm's method; 3 to 4 drops of the melted and clarified sample is boiled for about 4 minutes in a not too narrow test-tube with 5 c.c. of a mixture of 25 c.c. of aqueous soda of sp. gr. = 1·38 and 125 c.c. of glycerol. The wax at first dissolves, but gradually the ley gets turbid, aqueous vapour passing off with much frothing. At a certain moment, the liquid separates sharply into an oily layer and a quite clear liquid, and the glycerol commences to distil. The source of heat is now removed, and the mixture introduced into another test-tube, when it is diluted with an equal bulk of hot water and once more boiled. When cold, the whole forms a jelly which is clear and transparent when the sample is pure, but is quite opaque if more than 5 per cent. of paraffin or ceresin is present. The test fails when the adulteration is only about 3 per cent., and, therefore, it is as well to repeat the experiment after, purposely adding 3 per cent. of ceresin; if a marked opacity is observed, the sample must have contained at least 3 per cent. of the adulterant. L. DE K.

Estimation of Alkaloids in Pharmaceutical Preparations. By KARL KIPPENBERGER (*Chem. Centr.*, 1897, ii, 646—647; from *Apoth. Zeit.*, 12, 459—460; 467—469).—The extract is dissolved in warm acidified water, filtered if necessary, and precipitated by means of a solution of iodine in a large excess of potassium iodide. The deposit is then repeatedly washed with cold water, preferably on a Gooch's crucible, and after being repeatedly extracted with purified acetone, the latter is diluted with water and shaken with light petroleum first in the presence of alkali and then of acid. The aqueous layer is then warmed to drive off the acetone and traces of light petroleum, and when cold a few drops of N/10 solution of sodium thiosulphate are added. The liquid is rendered alkaline with sodium carbonate or ammonia and extracted by agitation with chloroform or ether (compare Abstr., 1896, ii, 681—682). L. DE K.

Behaviour of Codeine and Morphine with Pure Sulphuric Acid. By MICHAIL P. SERGÉEFF (*Chem. Centr.*, 1897, ii, 664—665; from *Pharm. Zeit. Russ.*, 36, 431—432).—When 1 c.c. of sulphuric acid is poured on to 0·01 gram of codeine, and the mixture viewed by reflected light, purple-violet rings may, after a few minutes, be seen to form round each grain. The coloration appears more quickly on heating, and is then more purple, turning finally to olive-green. When morphine is dissolved in sulphuric acid, the solution is not as clear as that of codeine, and exhibits a brownish-violet coloration, possibly due to partial charring. A saturated solution of morphine hydrochloride in sulphuric acid, after remaining a month, had changed into a gelatinous mass, and still showed the coloration.

E. W. W.

Detection of Aloes. By PIERRE APÉRY (*Zeit. anal. Chem.*, 1898, **37**, 276; from *Mitth. Soc. Imp. Med. Constantinople*).—A filtered alcoholic extract of the substance is evaporated to dryness, the residue warmed with water, and the filtered solution precipitated with lead acetate. The lead is removed from the filtrate by boiling with sodium carbonate, and the filtrate is acidified with acetic or nitric acid. A drop of dilute ferric cloride solution gives a distinct reddish-brown coloration when aloes is present to the extent of 1 part in 2000—3000 of water.

Tannin and substances containing phenols, as kola nut, areca nut, &c., also give brownish-red colours with ferric chloride, but since these tonics are usually not simultaneously administered when aloes is given for criminal purposes, and since other drastics, such as savin, absinthin, laxative gum resin, &c., do not give the reaction, the method seems suitable for the chemico-legal detection of aloes.

M. J. S.

Analysis of Commercial Indigo. By C. BRANDT (*Chem. Centr.*, 1897, ii, 813; from *Rev. Intern. Falsif.*, **10**, 130—131).—The author substitutes aniline for naphthalene in Schneider's process, as the ethereal solution of the latter deposits solid matter on the filter and so necessitates using large quantities of ether. 0·2 gram of indigo is extracted in a Soxhlet's tube with aniline for about an hour; when cold the indigo will crystallise. Dilute hydrochloric acid is now added to dissolve the aniline as hydrochloride, and the indigotin is then collected on a tared filter and washed first with boiling water and then with alcohol, which at the most dissolves 0·5 per cent. of the total indigotin. L. DE K.

Detection of Blood. By JESERICH (*Zeit. anal. Chem.*, 1898, **37**, 276; from *Pharm. Centr.*, **32**, 708).—Photography can be employed to detect blood on steel instruments from which the stains have been wiped, the streaks produced by the wiping being distinctly visible in the photograph.

Amongst mammals, the camel and elephant alone have larger blood corpuscles than man; where these are known to be absent the presence of human blood may be inferred with certainty if the corpuscles have a diameter as great as 0·0078 millimetre. M. J. S.

General and Physical Chemistry.

Influence of Temperature on the Rotatory Power of Liquids. By PHILIPPE A. GUYE and EMILY ASTON (*Compt. rend.*, 1897, **125**, 819—821).—In a former paper (Abstr., 1897, ii, 237), the authors have shown that, in the case of at least fifty optically active liquids, the rotatory power diminishes with a rise of temperature. An apparent exception to this general behaviour in active compounds is afforded by amylic alcohol. The rotatory power of this compound at first diminishes as the temperature rises, but a minimum is reached, and the rotatory power then increases with the temperature, the increase being even maintained in the passage from liquid to vapour. The authors explain this behaviour by pointing out that amylic alcohol is, according to Ramsay and Shields' investigations, an associating liquid, and that the rise of temperature therefore in this case produces a simplification in the molecular structure. That the increase in rotatory power is due to this simplification is shown by the fact that in solution in water, a liquid that effects the dissociation of dissolved substances, amylic alcohol gives a value of $[\alpha]_D = -5{\cdot}1$, but in solution in benzene, a solvent which has no dissociating properties, the value of $[\alpha]_D$ is only about $-4{\cdot}5$. H. C.

Relations Connecting the Thermal Constants of the Elements. By NOEL DEERR (*Chem. News*, 1897, **76**, 234—237).—The empirical relations between the thermal constants of the elements proposed by Pictet, Richards, Crompton, and Deerr are submitted to a critical examination. If T is the absolute melting point, L the latent heat of fusion, C the mean coefficient of expansion, and S the mean specific heat between $-273°$ and T, the relations $TC = \text{const.}$ and $LC/S = \text{const.}$, and from these also $TS/L = \text{const.}$, hold between such elements as bear a close relationship to each other, and hence generally for members of any one periodic group. The other proposed relations are either variations of these, or do not stand the test of a close criticism. The author employs these expressions for the calculation of some undetermined latent heats of fusion. H. C.

Heat of Vaporisation of some Elements and their Molecular Weight in the Liquid State. By ISIDOR TRAUBE (*Ber.*, 1898, **31**, 1562—1563).—For the seven elements Br_2, I_2, Zn, Cd, Hg, Bi, S_2 (the molecular formulæ in the gaseous state are quoted), the rate of variation of vapour pressure with temperature (in the neighbourhood of the normal pressure), dp/dT, can be calculated from observations, and then, making use of Clausius' formula $\rho = Tdp/dT\,(V_1 - V_2)$ (where T is the boiling point in absolute temperature, V_1 and V_2 the specific volumes of vapour and liquid at that temperature), it is possible to calculate ρ, the latent heat of vaporisation; this agrees fairly well with that observed.

	Br.	I.	Zn.	Cd.	Hg.	Bi.	S.
Calculated......	46·7	34·9	390·1	209·6	69·0	201·6	339·9
Observed	43·7	—	—	—	62·0	—	362·0

Substituting these values for ρ in the expression $m\rho/T$ (where m is the molecular weight in the gaseous state), we ought, according to Trouton's rule, to obtain a number approximating to 20·63 *if the substance have the same molecular weight in the liquid as in the gaseous state.* This is the case (= 19·4 to 22·5) with all the above elements except sulphur; for this the value is 30·2. C. F. B.

Calories of Combustion in Oxygen of Cereals and Cereal Products, calculated from Analytical Data. By HARVEY WASHINGTON WILEY and W. D. BIGELOW (*J. Amer. Chem. Soc.*, 1898, **20**, 304—316. Compare this vol., ii, 206).—The bomb calorimeter invented by Berthelot and Vieille, in which the substance is burnt in compressed oxygen, has made it possible to determine the calories of combustion of foods with a fair degree of accuracy in agricultural laboratories.

The figure obtained should not differ by more than 75 calories from the result obtained by calculation from the chemical composition of the food; as there is a great difference in the number of calories of the carbohydrates, the proteids and the fatty matters, this is readily done. Should the difference be greater, both the analysis and the combustion in the bomb should be repeated. L. DE K.

Influence of Superfusion on the Freezing Points of Solutions of Potassium Chloride and Sugar. By FRANÇOIS MARIE RAOULT (*Compt. rend.*, 1897, **125**, 751—754).—The author has determined the freezing points of aqueous solutions of potassium chloride and cane-sugar, using the same apparatus and precautions which were employed in the determinations with sodium chloride and alcohol (Abstr., 1897, ii, 362). The molecular reduction in the case of potassium chloride increases as the concentration diminishes, and tends to the maximum value 36·4 for infinite dilution. The molecular reduction for cane-sugar diminishes with increasing dilution, and has the limiting value 18·72. The results agree perfectly with those predicted by Arrhenius. H. C.

Compressibility of Gases under Approximately Atmospheric Pressure. By ANATOLE LEDUC and PAUL SACERDOTE (*Compt. rend.*, 1897, **125**, 297—299).—In a previous paper (Abstr., 1897, ii, 133), one of the authors has shown that the compressibility of different gases at the same temperature, and approximately under atmospheric pressure, is given by the expression $P_0V_0/PV - 1 = A(P - P_0)$. The product $A\pi$ of the coefficient A and the critical pressure π of the gas is a function of the critical temperature θ, so that one and the same function $Z = A\pi = f(\theta)$ should apply to all gases obeying the above law. Eighteen gases were examined, and the values of θ plotted against those of $A\pi$. Fourteen of the points so obtained were found to lie on a regular curve, but the points obtained for the three gases methane, methylic chloride, and ammonia lie well off the curve on the one side, and the point given by hydrogen sulphide lies off the curve on the other side. Regarding the behaviour of the first fourteen gases as normal, the general equation to the curve is $Z = mx^2 - nx^3 + px^4$, in which $x = 175 + \theta$, $m = 135 \times 10^{-5}$, $n = 338 \times 10^{-8}$, $p = 145 \times 10^{-10}$. With the aid of this expression, it is possible to calculate the critical pressure from the known critical temperature in the case of gases of normal behaviour. The authors have in this way calculated the following critical pressures: acetylene, 67 atm.; hydrogen chloride, 83 atm.; methylic ether, 57 atm.

H. C.

Molecular Volumes and Densities of Gases at all Temperatures and at Mean Pressures. By ANATOLE LEDUC (*Compt. rend.*, 1897, **125**, 703—706).—A general expression is obtained for the correction γ, which has to be applied to the observed molecular volume of each gas in order to obtain the molecular volume of the same gas in an ideally perfect state. A close agreement between the calculated and observed values for the densities is obtained in the examples given by the author. H. C.

Coefficients of Dilatation of Gases at Mean Pressures. By ANATOLE LEDUC (*Compt. rend.*, 1897, **125**, 768—770).—The general expression obtained by the author for the densities of gases at different temperatures (see preceding abstract) is utilised for the purpose of calculating the coefficients of dilatation. The calculated and observed values in the examples quoted are in close agreement. H. C.

Study of Physical and Chemical Equilibria by the Osmotic Method. By A. PONSOT (*Compt. rend.*, 1898, **126**, 335—338).—A theoretical paper in which the limitations to the osmotic method of dealing with physical and chemical equilibria are discussed. H. C.

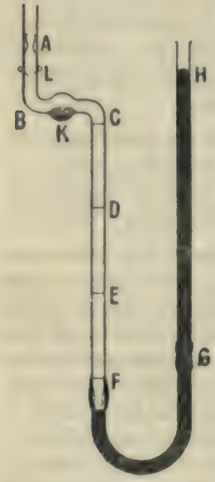
Rate of Dehydration of Crystallised Salts. By THEODORE WILLIAM RICHARDS (*Zeit. anorg. Chem.*, 1898, **17**, 165—169).—The rate at which water is withdrawn from a salt by a dehydrating agent varies greatly for different salts, and for different hydrates of the same salt. In the case of barium chloride, the dehydration takes place rapidly until the point $BaCl_2 + H_2O$ is reached, and then the further dehydration proceeds much more slowly. Most salts which contain a small amount of water of crystallisation behave like barium chloride; but with salts containing a large quantity of water of crystallisation, the curve for the rate of dehydration gives little, or no, indication of the presence of definite hydrates. In order to detect the points at which different hydrates are present and at which a different rate of dehydration commences, it is necessary to employ as the dehydrating agent a substance whose vapour tension is not much less than that of the salt which is being dehydrated. For this purpose, sulphuric acid of various strengths is the most convenient, and the author gives a table of the vapour tension of sulphuric acid of various densities.

E. C. R.

Taste and Affinity of Acids. By J. H. KASTLE (*Amer. Chem. J.*, 1898, **20**, 466—471).—The author has carried out a series of experiments with nineteen inorganic and organic acids in order to ascertain whether their degree of sourness could be used to approximately determine their strength. Richards (this vol., ii, 209) has already shown that a qualitative relation exists between the sour taste of acids and their electrolytic dissociation. In the author's experiments, a dilution of N/50 was employed, and over 400 observations were made on 16 individuals of both sexes. About 74 per cent. of the observations indicated that a definite relation does exist between the taste of acids and their coefficients of affinity.

The author suggests that acidic substances like picric acid and benzoic sulphinide, which are not sour, owe their characteristic taste to the negative ion, since the taste persists in their salts; on the other hand, the sourness of acids which depends on the hydrogen ion, disappears on neutralisation. G. T. M.

Apparatus for Determining the Composition of Ammonia, Sulphurous Anhydride, Water, &c. By GEORGE GEORGE (*Chem. News*, 1898, 77, 203).—The apparatus consists of a bent tube, AF, of Jena glass of about ½ inch bore, the limbs AB and BC being each about 3 inches long, and CF about 24 inches. The tube is graduated, so that the portions AC, CD, DE, and EF contain equal volumes. To determine the composition of ammonia, a piece of tubing, provided with a clip, is attached to A, the whole tube filled with mercury by raising the pressure tube, HG, and the dry gas introduced through A. A short thistle funnel is then attached to A, and in it is placed some freshly-ignited copper oxide. By raising the pressure tube and opening the clip, the oxide is made to enter the tube, whilst the escape of ammonia prevents the entry of air. The gas is allowed to escape until AD is just filled at the atmospheric pressure. Sparks are then passed through the electrodes, L, for some time. On cooling and adjusting the pressure, the volume of the gas will have increased to AF (nearly). The copper oxide in the bulb, K, is now heated, and, after the reduction of the oxide by the hydrogen, the volume of the residual nitrogen, after cooling and adjusting the pressure, will occupy AC.



The composition of sulphurous anhydride may be proved by filling the tube with oxygen and burning sulphur in the bulb, that of water by exploding known volumes of oxygen and hydrogen, that of nitrous or of nitric oxide by decomposing the gas with potassium, and that of dry air by means of phosphorus. The apparatus can be obtained from Messrs. Baird and Tatlock.

E. W. W.

Inorganic Chemistry.

Preparation of Graphitic Acid. By LUDWIG STAUDENMAIER (*Ber.*, 1898, 31, 1481—1487).—Graphitic acid may be prepared quite easily in the following manner. One hundred c.c. of concentrated nitric acid (sp. gr. = 1·4) is mixed with 300 c.c. of ordinary strong sulphuric acid in a basin; 50 grams of powdered Ceylon graphite (or, still better, commercial "Graph. ceylon. alcoh.") is added to the cold mixture, and then 100 grams of potassium chlorate, in portions, at short intervals and with frequent stirring; after the whole has remained for several hours, it is poured into water, the solid is washed, dried, and ignited in a large metal dish until it has intumesced; finally, it is stirred with water, and the part that floats is used for further operations. Twenty-five grams of this prepared graphite is stirred into a cold mixture of 1 litre of strong sulphuric acid with ½ litre of strong nitric acid contained in a shallow basin, and then about 450 grams of potassium chlorate is added in portions at intervals; when the vigorous evolution of gas has slackened, and a small sample of the green solid is found to be pure yellow after treatment with acid permanganate, the whole is poured into water, and the solid is washed repeatedly by decantation (the gelatinous particles that obstinately refuse to settle may be poured away, as their weight is relatively very small); it is now brought into a basin, and to it is added a solution prepared by dissolving 7 grams of potassium permanganate in 120 c.c. of hot water, cooling, and adding a mixture of 15 c.c. of strong sulphuric acid and 75 c.c. of water; the whole is then heated on the water bath until the red colour has disappeared, hydrogen peroxide is added (or hydrochloric acid, with or without alcohol), the whole is allowed to remain for a time, being stirred occasionally, and the solid graphitic acid is then washed with dilute nitric acid (sp. gr. 1·28), and, finally, with alcohol and ether.

The operation lasts only 1—2 days, and in the winter-time, with the temperature little above 0°, 50—100 grams of graphite might be oxidised at once without risk of dangerous explosions. A specimen may be prepared in a couple of hours on quite a small scale by stirring 30 grams of chlorate into a mixture of 40 c.c. sulphuric and 20 c.c. nitric acids at 20°, adding 1 gram of prepared graphite, and proceeding to the final oxidation with permanganate after an hour or so.

C. F. B.

Oxidation of Sodium Sulphide by Electrolysis. By AUGUSTE SCHEURER-KESTNER (*Bull. Soc. Chim.*, 1897, [iii], 17, 99—100. Compare Abstr., 1896, ii, 559).—The author contends, in opposition to Durkee, that sodium sulphide, on electrolysis, is oxidised directly to sodium sulphate, without the intermediate formation of thiosulphate.

N. L.

Solubility of Calcium and Magnesium Hydrogen Carbonates. By FREDERICK PEARSON TREADWELL and M. REUTER (*Zeit. anorg. Chem.*, 1898, 17, 170—204).—Calcium hydrogen carbonate is present as such in an aqueous solution prepared by saturating a solution of lime with carbonic anhydride, and then allowing the free carbonic anhydride to escape at 15° and 760 mm. pressure. One litre of water dissolves 0·3850 gram of calcium hydrogen carbonate. The paper contains tables and curves of the solubility of calcium hydrogen carbonate in water containing carbonic acid, showing the solubility as a function of the partial pressure of the carbonic acid and as a function of the free carbonic acid dissolved in the water. The solubility of calcium hydrogen carbonate is not increased by the presence of sodium chloride.

Magnesium hydrogen carbonate is not stable except in the presence of free carbonic acid. At 15° and 760 mm., a solution having the partial pressure of the carbonic anhydride = 0 contains 1·9540 grams of hydrogen carbonate and 0·7156 gram carbonate in 1 litre.

Experiments with solutions of sodium hydrogen carbonate show that they gradually decompose after a time. E. C. R.

Action of Zinc on Copper Silicide. By GUILLAME J. L. DE CHALMOT (*Amer. Chem. J.*, 1898, 20, 437—444).—The author finds that zinc decomposes copper silicide, liberating silicon, whilst tin and antimony do not affect this compound. The silicide employed in the experiments consisted of 50—52 per cent. of Cu_2Si, free copper, and a small amount of iron silicide; the zinc used contained only traces of iron and carbon. The silicide was first melted, and the molten zinc then added; the silicon liberated was always crystalline. Experiments made with varying quantities of zinc showed that practically no silicon was liberated until the quantity of zinc present was in excess of that required to form the compound $ZnCu_2$ with the free copper. Above this limit, the quantity of silicon liberated increased as the excess of zinc became greater, until when the ratio of copper to zinc was 100 to 195, about 95 per cent. of the total silicon was in the free state.

G. T. M.

Metallic Phosphides. By ALBERT GRANGER (*Chem. News*, 1898, 77, 227—229; from *Mon. Sci.*, [iv], 12, May, 1898).—Largely a *résumé* of work previously published (see Abstr., 1895, ii, 392; 1896, ii, 365, 476, 602, 650; 1897, ii, 215, 265, 323, 371, 453).—The author has examined the various methods of preparing metallic phosphides, and described a number of these compounds. When phosphides are prepared by passing an inert gas containing phosphorus vapour over a heated metal, the product should be cooled in an atmosphere of phosphorus in order to prevent dissociation. With metals, phosphorus is capable of forming substances similar to alloys, which often have the appearance of compounds, and sometimes are crystalline; such are the alloys Cu_3P and Fe_4P of Abel and Sidot; the former yields a definite compound, Cu_5P_2, by the prolonged action of phosphorus, and the latter may be obtained, with other more or less dephosphorised products, by heating iron subphosphide for a long time. By the action of phosphorus trichloride on metallic iron, and by heating ferric chloride in the vapour of phosphorus, the author has prepared Fe_4P_3 and Fe_2P_3 respectively; these phosphides crystallise in white, prismatic needles, and are not easily attacked except by chlorine. Pure crystalline cuprous phosphide can be obtained by allowing phosphorus to remain with copper phosphite under water. Manganese phosphide, Mn_3P_2, is formed in thin, brilliant plates by heating the chloride in a current of the vapour of phosphorus in hydrogen. When phosphorus di-iodide is heated with mercury, the phosphide Hg_3P_4 is obtained in hexagonal prisms; it is easily decomposed by heat. Silver or silver chloride, when heated in the vapour of phosphorus at 400°, forms a diphosphide which decomposes at 500°, and under similar conditions gold yields a phosphide, Au_3P_4, which is easily decomposed by heat. Platinum, when heated with phosphorus, forms easily fusible compounds; at 500°, the diphosphide is obtained; at about 600°, the phosphide Pt_3P_5; above 700°, a subphosphide; at 1000°, only a very small percentage of phosphorus is retained by the metal. Lead, bismuth, and antimony do not combine with phosphorus directly.

E. W. W.

Atomic Weight of Nickel and Cobalt. By Clemens Winkler (*Zeit. anorg. Chem.*, 1898, **17**, 236—240).—The author compares the method employed by himself with that employed by Richards and Cushman and Richards and Bunter (this vol., ii, 228, 377). He maintains that his method is most accurate, and points out that the dry bromide obtained in Richards' method most probably contains a trace of hydrogen bromide.

E. C. R.

Action of Nitric Acid on Tin in Presence of Metals of the Iron Group. By Frederik Hendrik van Leent (*Rec. Trav. Chim.*, 1898, **17**, 86—93).—When tin is dissolved in nitric acid in presence of one-fifth or one-sixth of its weight of iron, and the solution evaporated to dryness, a product completely soluble in water is obtained; on adding concentrated nitric acid to the aqueous solution, a precipitate is obtained containing the whole of the tin, and a considerable proportion of iron which it is impossible to remove. When dried by exposure during several weeks in a vacuum over caustic potash, the product gradually loses water and nitric acid; analyses show that there is no constant relation between the amounts of iron and nitric acid present. The dried product dissolves in water, giving a solution from which metastannic acid is precipitated by an excess of hydrochloric acid; on subsequently boiling, the precipitate dissolves, and on adding cæsium or rubidium chloride, characteristic crystals of cæsium or rubidium chlorostannate are obtained. When, however, a small quantity only of hydrochloric acid is added to the original aqueous solution no precipitate is formed, and on adding cæsium or rubidium chloride an amorphous precipitate is obtained. By these tests, the two varieties of stannic acid are distinguished (compare Behrens, *Anal. qual. microchim.*, 63).

The author finds that the nitrates of chromium and aluminium exercise the same power of rendering metastannic acid soluble as ferric nitrate, whilst this is not the case with the nitrates of nickel, cobalt, and manganese.

W. A. D.

Relation between the Colour and the Constitution of Haloid Double Salts. By Nicolai S. Kurnakoff (*Zeit. anorg. Chem.*, 1898, **17**, 207—235).—Compounds of the type $MCl_2,PtCl_2,4NH_3$ exist in two isomeric forms of which those which may be represented by the formula $(MCl_2,4NH_3),PtCl_2$, are characterised by their red to violet-red colour, whilst the isomeric compounds, $MCl_2(PtCl_2,4NH_3)$, have the same colour as the corresponding anhydrous metallic chlorides, or as the analogous anhydrous double salt; for example, $ZnCl_2(PtCl_2,4NH_3)$ is colourless, as is also $ZnCl_4K_2$, whilst

$$CuCl_2(PtCl_2,4NH_3)$$

and $CuCl_4R_2(R = Cs,NMe_4)$ are both brownish-yellow. The corresponding *palladium* compound, $CuCl_2(PdCl_2,4NH_3)$, also crystallises in dark yellow tablets; it is obtained by mixing solutions of copper chloride and $PtCl_2,4NH_3$, and is decomposed by excess of water and hydrochloric acid.

The alteration of colour by the introduction of water, ammonia, or its derivatives into inorganic salts is analogous to that which takes place by the introduction of bathochromic groups into organic compounds. Thus $PdCl_2$ is reddish-brown; $PdCl_2,2NH_3$, yellow; and $PdCl_2,4NH_3$, colourless; $CoCl_3,4NH_3$ (praseo-salt) is green; $CoCl_3,5NH_3$ (purpureo-salt), red; and $CoCl_3,6NH_3$ (luteo-salt), yellow.

In the formation of double salts, the colour is generally produced by the addition of the colours of the components; thus the violet salt, $(CuCl_2,4NH_3),PtCl_2$, is produced from the green salt, $CuCl_2,4NH_3$, and the red chloroplatinite. The coloration of double salts is not, however, very regular. A deepening of the colour often takes place whereby yellow salts are formed from colourless constituents, or dark red salts from brown, as in the double compounds of $CuBr_2$ with KBr and HBr.

The author has examined the cobalt and copper compounds of the types I, $(MX_2nA)M_1X_2$ and II, $MX_2(M_1X_2nA)$ where

$$A = NH_3,C_5H_5N,C_2H_4(NH_2)_2$$

and H_2O.

In series I, the colour of the compound is normal as regards the metal M, that is, the normal colour of the component MCl_2nA is a component of the colour of the double salt. In series II, the colour of the compound is abnormal as regards the metal M, that is, the component MCl_2, in so far as colour is concerned, behaves as if anhydrous.

The author proposes to name compounds of the type $MX_2(M_1X_2nA)$ *chlorometallites*, in accordance with the name chloroplatinites, thus $CuCl_2(PtCl_2,4NH_3)$ and $CoCl_2(PtCl_2,4NH_3)$ he names platodiammine chlorocuprite and platodiammine chlorocobaltite.

Chlorocobaltites.—The difference in the colour of anhydrous cobalt chloride, and of its compounds with water and ammonia, is also apparent in the corresponding double salts. When cobalt chloride is combined with colourless ammonium, pyridine, and ethylenediammine salts of the type $PtCl_24A$, a series of salts of the formula $CoCl_2(PtCl_2,4A)$ is obtained which have the blue colour of cobalt chloride.

Platodiammine chlorocobaltite, $CoCl_2(PtCl_2,4NH_3)$, obtained by adding finely powdered platodiammine chloride to a boiling saturated solution of cobalt chloride, crystallises in transparent, blue, rhomboidal tablets, decomposes into its components when dissolved in water, and yields a red solution with excess of water. The corresponding *pyridine* compound, $CoCl_2(PtCl_2,4C_5NH_5)$, crystallises in small, thin tablets, and is very easily decomposed into its components. The *ethylenediammine* compound crystallises in beautiful, blue prisms, is very stable, and can be warmed with hydrochloric acid for some time without decomposition.

The relation of the colour of the chlorometallites to the colour of their anhydrous components is also shown in the compounds of cobalt and copper chloride with ethylenediammine hydrochloride. The *cobalt* compound, $CoCl_2(C_2H_8N_2,2HCl)$, crystallises in large, blue tablets. The *copper* compound crystallises in brownish-yellow, quadratic tablets.

Chloroplatinites.—The *salt*, $PtCl_2(CoCl_2,6NH_3)$, obtained by adding a solution of potassium platinosochloride to an ammoniacal solution of cobalt chloride in an atmosphere of hydrogen or nitrogen, crystallises in thin, yellowish-red, right-angled tablets, is decomposed by water with the formation of an insoluble basic compound, and yields a blue solution with hydrochloric acid; it is stable when dry, but when allowed to remain for some time over sulphuric acid it loses ammonia and is converted into a mixture of the salts, $PtCl_2(CoCl_2,6NH_3)$ and $PtCl_2(CoCl_2,4NH_3)$. The ammonia in this double salt is evidently more firmly combined than in the salt $CoCl_2,6NH_3$, which at the ordinary temperature rapidly gives off ammonia when allowed to remain over sulphuric acid. The corresponding *nickel* salt, $PtCl_2(NiCl_2,6NH_3)$, which is obtained in a similar manner, crystallises in rose-red, four-sided tablets having a violet tinge.

The compounds obtained by the action of potassium platinosochloride on solutions of silver chloride in ammonia and ethylenediammine, are of a higher type as regards their capability of retaining ammonia than the compounds of silver chloride with ammonia and ethylenediammine. Freshly prepared silver chloride, when dissolved in a warm aqueous solution of ethylenediammine, yields the compound $(AgCl)_2C_2H_8N_2$, which is decomposed by water and alcohol with precipitation of silver chloride. When, however, the solution of silver chloride in ethylenediammine is treated with potassium platinosochloride, the compound $(AgCl,C_2H_8N_2),PtCl_2$ is obtained, which crystallises in microscopic, bright red tablets.

The chlorocuprite, $CuCl_2(PCl_2,4C_5NH_5,6H_2O)_2$, is obtained in yellow tablets by concentrating a mixed solution of copper chloride and platodipyridine chloride. A *salt* of the composition $(PtCl_2,4C_5NH_5)2CuCl_2$ is obtained from the mother liquor of the preceding salt and crystallises in reddish-brown, rhomboidal tablets.

The *chlorocobaltite*, $CoCl_2(CoCl_3,3C_2H_8N_2 + nH_2O)$, is obtained by evaporating a solution of $CoCl_3,3C_2H_8N_2 + 3H_2O$ and $CoCl_2 + 6H_2O$, and crystallises in dark green needles; it is easily decomposed by water with precipitation of the salt, $CoCl_3,3C_2H_8N_2 + 3H_2O$, but can be washed with concentrated hydrochloric acid without appreciable decomposition. When dehydrated in a desiccator or at 100—115°, it does not alter in appearance, the dehydration commences with great ease at ordinary temperatures, but the last 1—2 molecules are not lost even at 110—115°. The determination of the water of crystallisation gave numbers agreeing with 5 to $7{\cdot}5H_2O$.

The *chlorocuprite*, $CuCl_2(CoCl_3,3C_2H_8N_2 + H_2O)$, is obtained by evaporating a solution of equal weights of $CuCl_2 + 2H_2O$ and

$$CoCl_3,3C_2H_8N_2 + 3H_2O$$

in large, yellowish-brown tablets; it is only sparingly soluble in the presence of hydrochloric acid, and does not lose water when allowed to remain over sulphuric acid, but is completely dehydrated at 112°. The *salt*, $CuCl_2(CoCl_3,3C_2H_8N_2 + H_2O)_2$, is obtained by evaporating a solution of molecular proportions of $CuCl_2$ and $CoCl_3,3C_2H_8N_2$, and crystallises in prisms of the same colour as the preceding salt.

A *chlorocuprite* of the composition $(CuCl_4,Pt2C_2H_8N_2)_3,PtCl_4,2C_2H_8N_2 + 9H_2O$, obtained by the action of platoethylenediammine chloride on copper chloride, crystallises in greenish-brown, prismatic needles. The corresponding bromide crystallises in dark brown needles. Both salts when dehydrated do not alter in appearance. E. C. R.

Mineralogical Chemistry.

Tellurium in the Product of the Eruption of the Island of Vulcano, Lipari Isles. By ALFONSO COSSA (*Zeit. anorg. Chem.*, 1898, **17**, 205—206).—Tellurium is present to the extent of 2 grams in 3 kilograms in the stalactiform concretions occurring largely in the crater of Vulcano (Abstr., 1878, 952; 1882, 704). The product of eruption is extracted with water, then with carbon bisulphide, and finally with dilute nitric acid. The acid solution is treated with hydrogen sulphide, which precipitates the tellurium together with a large quantity of sulphide of arsenic and metallic sulphides.

E. C. R.

Argon in the Vöslau Springs (Vienna). By MAX BAMBERGER and ANTON LANDSIEDL (*Monatsh.*, 1898, **19**, 114, 115).—The authors find that the gases from the Vöslau springs contain from 1·29—1·38 per cent. of argon. A. W. C.

New Experiments on Zeolites. By GEORGES FRIEDEL (*Zeits. Kryst. Min.*, 1898, **29**, 278—279; from *Bull. Soc. fran. Min.*, 1896, **19**, 363—390. Compare Abstr., 1896, ii, 481, 482).—The amount of water given off by analcite at a definite temperature is dependent on the tension of aqueous vapour in the air; it is therefore necessary, when determining the amount of water lost on heating zeolites, to observe the tension of aqueous vapour as well as the temperature. Constant results are only obtained when the powdered mineral is heated in a rapid current of dry air. If, after dry air has been used, a current of moist air be passed over the heated mineral, there is, in spite of the elevated temperature, an absorption of water, and to expel this again with the same tension of aqueous vapour, a higher temperature is required. Equilibrium in such cases is more rapidly established the higher the temperature; that is, water is more slowly re-absorbed the lower the temperature.

More accurate determinations of the sp. gr. and contraction in volume of partially dehydrated analcite have been made. The contraction continues after all the water has been expelled, the material being then transparent and isotropic, and with numerous microscopic cavities. The optical behaviour of a plate parallel to a cube face when heated is described. Analcite is considered to be tetragonal (pseudocubic) like leucite. L. J. S.

Physiological Chemistry.

Absorption of Fat. By R. H. Cunningham (*J. Physiol.*, 1898, **23**, 209—216).—After ligature of both biliary and pancreatic ducts, some absorption of fat, other than the naturally emulsified fat of milk, still occurs. The rate of absorption is slow, and the quantity absorbed small, but otherwise the process does not differ from that which occurs normally, when both bile and pancreatic juice are present. The experiments were made on dogs. W. D. H.

Metabolism of Nucleins. By T. H. Milroy and J. Malcolm (*J. Physiol.*, 1898, **23**, 217—239).—The digestive products of nuclein-containing tissues, nucleins, and especially nucleic acid, cause, on absorption, a temporary leucocytosis, accompanied by an increase in the excretion of phosphoric anhydride, beyond that which can be explained by the phosphorus absorbed. The alloxuric substances are also increased, whilst the uric acid is only slightly increased, but the experiments being made on human beings, only small doses of nucleic acid were administered, unpleasant symptoms being caused by large doses. Metaphosphoric acid produces none of these results.

The leucocytosis is followed by leucolysis, and this is considered to be the cause of the increase in the urinary phosphates. In a case of leucocythæmia, leucolysis did not occur, and increase in the phosphates excreted was not observed either; the alloxuric substances including uric acid were, however, increased in this case.

In a case of plumbism, the conditions are comparable with those existing normally in spite of the leucocytosis, which was not, however, very marked.

In all cases, uric acid was absent in the fæces. W. D. H.

Osmotic Properties of Frog's Muscle. By Elizabeth Cooke (*J. Physiol.*, 1898, **23**, 137—149).—A muscle immersed in a hypertonic solution of sodium chloride does not behave according to the laws of osmotic pressure, but owing doubtless to decomposition processes consequent on its taking up water, the muscle behaves like a solution having a higher osmotic pressure than the solution for which it is isotonic. Rise of temperature and fatigue increases the osmotic pressure within the muscle. W. D. H.

Action of Cobra Venom and Calmette's 'Anti-venomous Serum' on Blood Clotting. By J. W. W. Stephens and W. Myers (*Proc. Physiol. Soc.*, May, 1898, 1).—Cobra venom delays or prevents the clotting of rabbits' blood; this effect is neutralised *in vitro* by Calmette's anti-venomous serum. The neutralisation of the toxin by the anti-toxin must be chemical, not vital or cellular as Calmette considers. The blood of a rabbit, immunised with injections of cobra-poison, so far as clotting is concerned, has also acquired a certain amount of immunity against cobra poison. W. D. H.

Chemistry and Action of the Thyroid Gland. By ROBERT HUTCHISON (*J. Physiol.*, 1898, **23**, 178—189).—The iodine contained in the colloid matter of the thyroid varies considerably, and averages 0·309 per cent. Of the digestion product of the colloid, only those which contain iodine are active. Iodised nucleo-albumin, made artificially from the thymus, has no physiological activity, and increase in activity of the thyroid colloid is not produced by artificial addition of iodine, although in the natural products the amount of iodine and the activity vary directly. Intravenous injection of the colloid has no effect on blood pressure, heart, or coagulation of the blood. Thyroid extracts produce a fall of arterial pressure, but this is due to extractives and partly to mineral salts present.

Previous removal of ovaries or testes has no influence on the results of thyroidectomy, and ovarian feeding has no curative influence in myxœdema. No poison was discovered either in the bile or the central nervous system after thyroidectomy.

Of 24 consecutive cases of complete thyroidectomy, only four survived; this number can only be slightly increased by thyroid feeding. Parathyroid feeding has no effect in myxœdema. Keeping the animals warm after the operation has no effect. W. D. H.

Changes in the Urine produced by Exercise and by Turkish Baths. By G. C. GARRATT (*J. Physiol.*, 1898, **23**, 150—162).—Rapid but not laborious exercise (on a bicycle) produces an increase in urea excretion, reaching a maximum in 12 hours but not regaining the normal level for 30 hours afterwards, the increase beginning immediately after the exercise. The excretion of uric acid rises to the maximum six hours after the exercise. If the subject is not in good condition or the food insufficient, the rise is greater and lasts longer. There is an increase in the acidity after exercise which runs parallel to the urea, and a small increase in the urinary phosphates which follows the same course. The increase in the sulphates is proportional to that of the urea, but is of less duration and therefore of more intensity; it begins during the exercise, reaches a maximum in six hours or less, and terminates within 12 or 14 hours. The chlorides of the urine diminish and vary with the amount of sweating. Turkish baths produce a reduction in the water and in the chlorides excreted by the kidneys. W. D. H.

Chemistry of Vegetable Physiology and Agriculture.

Alcoholic Fermentation without Yeast Cells. VII. Preparation of Dried Yeast Juice. By EDUARD BUCHNER and RUDOLF RAPP (*Ber.*, 1898, **31**, 1531—1533).—Five hundred c.c. of freshly expressed yeast juice is mixed with a few drops of olive oil, and evaporated rapidly under diminished pressure at 20—25° to a syrupy consistency; this requires about half-an-hour. The syrup is then spread on glass plates cleaned with ether, and dried for about a day, either under diminished pressure at 35°, or in the air at 34—38°, or at 25°; the residue is then scraped off and dried further over sulphuric acid, preferably under diminished pressure. In this way, 70 grams of a yellowish powder, resembling dried egg-albumen in appearance, is obtained; it has a pleasant odour of yeast, and it dissolves almost completely in water; the solution, when diluted to the original volume, has nearly the same power of inducing fermentation as the original juice. C. F. B.

Alcoholic Enzyme from Yeast-cells. By Charles James Martin and H. G. Chapman (*Proc. physiol. Soc.*, June, 1898, 2).—An endeavour to procure a soluble alcoholic ferment from active yeast cells was unsuccessful. The procedure adopted varied from that used by Buchner in the omission of great pressure, centrifugal force being relied on to extract the ferment from the yeast which had been previously ground up with sand and siliceous earth. W. D. H.

Decomposition of Proteids and the Formation of Asparagine and Glutamine in Seedlings. By Ernst Schulze (*Chem. Zeit.*, 1897, **21**, 625—628. Compare *ibid.*, 1896, **20**, 143; Abstr., 1897, ii, 156; and this vol., ii, 133).—The results of the author's experiments leave it undecided as to the manner in which asparagine and argenine are produced from other products of the decomposition of proteids, but there can be no doubt that both amides can be produced in the plant from ammonia (Suzuki, Abstr., 1897, ii, 277), and if it is admitted that ammonia (which has been detected in seedlings) is formed during the decomposition of proteids, the synthesis of the amides can be explained in this way. The substances formed when the proteids break up are in part utilised in the regeneration of proteids, some being so utilised to a much greater extent than others. It is suggested that the latter decompose further, and that the nitrogenous residue, perhaps ammonia, is used up in the production of the amides, the accumulation of which would be thus accounted for. It is, however, not impossible that a certain amount of asparagine may be formed directly in the decomposition of proteids.

The decomposition of proteids in seedlings consists in the hydrolytic breaking up of the proteid-molecule, and is, perhaps, similar to what takes place in the animal organism (compare Drechsel, Abstr., 1892, 515). Not only in animals, but probably in plants also, the sulphur of the proteids is finally converted into sulphates (compare *Landw. Versuchs.-Stat.*, 1876, **19**, 172). This lends support to the view that in plants, as in animals, the (non-nitrogenous) products of the breaking up of proteids undergo oxidation, and, in a certain sense, justifies the assumption of a connection between production of asparagine and the oxidation of proteids (Palladin, Abstr., 1888, 642; compare also Boussingault, *Compt. rend.*, 1864, **58**, 921—922). N. H. J. M.

Analytical Chemistry.

Micro-chemical Detection of Perchlorates in Chili Saltpetre. By M. VAN BREUKELEVEEN (*Rec. Trav. Chim.*, 1898, 17, 94—95).—Behrens' method of testing a solution for perchlorates consists in adding to a drop of the latter on a microscope-slide a small quantity of rubidium chloride; rhombic crystals immediately separate, which are stained red by the addition of a drop of potassium permanganate solution, the latter being rendered colourless. This test gives satisfactory results with aqueous solutions containing more that 0·001 gram of potassium perchlorate per c.c.; but its sensitiveness is diminished by the presence of sodium nitrate, so that it just ceases to be available when 5 grams of Chili saltpetre containing 0·6 per cent. of perchlorate is dissolved in 10 c.c. of water. If the nitrate contains more than 0·6 per cent. of perchlorate, the amount of the latter can be determined approximately by carefully diluting until the limit of sensibility of the test is reached. When the perchlorate forms only 0·2—0·6 per cent. of the nitrate, its presence can be detected by dissolving 10 grams of the latter in 10 c.c. of warm water, adding 50 c.c. of 95 per cent. alcohol, boiling, and leaving to crystallise during 2 hours; on filtering, evaporating to dryness, and dissolving the residue in the least possible quantity of water, a solution is obtained which can be tested by Behrens' method. W. A. D.

Gladding's Method for [the Estimation of] Phosphoric Acid. By JOHN B. COPPOCK (*Chem. News*, 1898, 77, 242).—The author finds that, whilst Gladding's method of estimating phosphoric acid (this vol., ii, 405) gives higher results than the magnesia method, it affords a quick and sufficiently accurate process for the ordinary analysis of fertilisers. E. W. W.

Estimation of Phosphorus and Sulphur in Iron, Steel, and Cast Iron. By MAURICE LUCAS (*Bull. Soc. Chim.*, 1897, [iii], 17, 144—150).—Comparative analyses have been made by a number of well-known methods, and the results obtained are exhibited in a tabular form. The chief conclusions arrived at are as follows.

The results given by those methods in which phosphoric acid is precipitated by ammonium molybdate in presence of hydrochloric acid, or of chlorides, are too low; nitric and sulphuric acids, on the other hand, appear to be without influence in this respect. A common source of error lies in the insufficient quantity of molybdate employed. For every 2 parts of iron in solution 3 parts of molybdic acid are required, whilst it is also indispensable that ammonium salts should be present, and that the temperature should be raised to 80°. In the precipitation of phosphoric acid along with basic acetate of iron, a process which is convenient when arsenic is present, it is necessary to precipitate three or four times as much iron as is required to combine with the phosphoric acid, and to remove all acids but nitric before adding the ammonium molybdate.

The whole of the sulphur contained in the metal is expelled as hydrogen sulphide when hydrochloric acid, or a mixture of the latter with sulphuric acid, is used as the solvent, the gases evolved being afterwards passed through a red-hot tube. Low results are obtained when sulphuric acid alone is employed. Of the various methods of estimating the hydrogen sulphide thus produced, the best results are obtained (*a*) by converting it into sulphuric acid and then into barium sulphate, (*b*) by iodometric titration, and (*c*) by the author's colorimetric process (this vol., ii, 483). N. L.

Application of the Colorimetric Method for Estimating Lead to the Estimation of Sulphur in Iron, Steel, and Cast Iron. By MAURICE LUCAS (*Bull. Soc. Chim.*, 1897, [iii], 17, 150—152).—The metal is heated in a current of hydrogen with a mixture of dilute hydrochloric and sulphuric acids, the gases evolved being passed through a red-hot porcelain tube, and finally received in a solution of lead oxide in caustic potash. The precipitated lead sulphide is filtered off, washed with water, dilute acetic acid, and then again with water, dissolved in nitric acid, the solution neutralised with caustic soda, suitably diluted, and examined colorimetrically according to the author's process for the estimation of lead (Abstr., 1897, ii, 125). N. L.

Sodium Peroxide in Quantitative Analysis. By CHARLES GLASER (*J. Amer. Chem. Soc.*, 1898, 20, 130—133).—A review of various propositions made since 1892 regarding the use of sodium peroxide as an oxidising agent either in the dry or in the wet way.

The reagent may be obtained perfectly free from iron, alumina, &c., and is the best oxidising agent for the estimation of sulphur in coal, coke, or asphalt.

The material is placed in a large silver or nickel dish, covered with four times its weight of dry sodium carbonate, and upon this is laid a piece of sodium peroxide about one-half the weight of the carbonate used. The dish is now moved carefully and slowly over a small flame until the evolution of gas subsides and a half-fused mass is obtained. Small quantities of powdered peroxide are now dusted in the mass from a platinum spoon from time to time until all the carbon has burnt away, when, if necessary, the heat may be raised until the mass is in perfect fusion. The sulphur is thus converted into sulphuric acid, which is then estimated as usual.

The author cannot recommend the reagent for chrome ore analysis. L. DE K.

Estimation of Boric Acid. By THOMAS S. GLADDING (*J. Amer. Chem. Soc.*, 1898, 20, 288—289).—The apparatus consists of a round-bottomed distilling flask placed in a slanting position. It is fitted with a doubly perforated cork, through which pass two bent glass tubes, one of which reaches to the bottom of the flask and is also connected with a larger flask in which methylic alcohol is being boiled; the second, or outlet, tube is connected with a condenser, and the distillate is collected in a Volhard's nitrogen bulb apparatus.

Into the distilling flask, which holds 150 c.c., 1 gram of the borate is introduced and also 25 c.c. of methylic alcohol and 5 c.c. of syrupy phosphoric acid; a current of methylic alcohol vapour is then passed in, and heat is also applied to prevent accumulation of liquid in the flask. After half an hour's action, when the distillate will measure about 100 c.c., the distillation is stopped and the distillate which now contains all the boric acid is mixed with 100 c.c. of water and 40 c.c. of glycerol, and titrated with standard soda, using phenolphthalein as indicator. The test-analyses are very satisfactory.

It has been noticed that ordinary borax, when distilled with methylic alcohol without the addition of an acid, gives up one-half of its boric acid. L. DE K.

Kopfer's Method for the Estimation of Carbon and Hydrogen. By JAMES JOHNSTONE DOBBIE and ALEXANDER LAUDER (*Chem. News*, 1898, **77**, 215—216).—According to the authors, Kopfer's method of estimating carbon and hydrogen by combustion in oxygen in the presence of platinised asbestos (this Journal, 1876, i, 660; 1877, i, 228) is inapplicable to the case of volatile substances, the difficulty of regulating the combustion so as to prevent the escape of unoxidised material being insuperable. Moreover, the results obtained with alkaloids containing large percentages of carbon and little nitrogen, such as cinchonine and corybulbine were invariably too low (compare Zeisel, *Monatshefte*, 1886, **7**, 557). E. W. W.

The Moist Combustion Method of Determining Carbon in Steel. By GEORGE AUCHY (*J. Amer. Chem. Soc.*, 1898, **20**, 243—253). —This is an elaborate investigation into the sources of error in the estimation of carbon by the moist combustion process.

The potash solution used to absorb the carbonic anhydride should have a sp. gr. = 1·4 and two absorbing apparatus should be used. The calcium chloride used for drying the gases should be freshly heated. The author also states that, notwithstanding all the usual precautions, results are occasionally obtained by this process which are decidedly too high; this may be explained by the formation of some volatile chlorochromic compound not absorbed by Langley's "pyro" mixture. L. DE K.

Lindo-Gladding Method of Estimating Potash. By A. L. WINTON and HOMER J. WHEELER (*Chem. News*, 1898, **77**, 263—265, 275—276).—The results of an examination of the Lindo-Gladding method of estimating potash, especially in reference to the objections of Breyer and Schweitzer, and of Vogel and Haefcke, that the addition of sodium chloride is liable to prove a source of error, and that potassium platinochloride is soluble in ammonium chloride solution, have proved these objections to be unfounded, in so far as practical considerations go. E. W. W.

Alkalimetric Estimation of Metals. By HENRI LESCŒUR (*Bull. Soc. Chim.*, 1897, [iii], **17**, 119—126; 126—132; 132—139; 140—144. Compare this vol., ii, 455).—*Estimation of Aluminium.*—Satisfactory results may be obtained by the direct titration of dilute solutions of potassium alum with caustic soda or baryta water, using phenolphthalein as indicator, but it is better to boil with a known excess of alkali and titrate back with acid. When free acid is present, this is first neutralised by the addition of alkali until the end-point indicated by helianthin is reached; phenolphthalein is then added, and the aluminium titrated as above described. Alumina may also be precipitated by ammonia in the cold, and the washed precipitate dissolved in standard acid and titrated back with alkali, using helianthin as indicator. The results obtained by this method are somewhat low, owing to the precipitation of basic aluminium sulphate. The indications given by both helianthin and phenolphthalein in presence of salts of aluminium are less sharp than usual, and the use of litmus is quite impracticable. With ammonium alum, the end-points are still less definite, and it is necessary to expel the ammonia, by boiling with caustic alkali, before the estimation of the alumina is attempted.

The separation of aluminium from other metals may be effected by the use of baryta water, in which alumina is fairly soluble. A complete separation, however, can only be attained by repeatedly treating the precipitate with baryta water, and the test analyses given are not very satisfactory.

Estimation of Iron.—Very dilute solutions of ferrous salts may be titrated directly with caustic soda in presence of phenolphthalein; or the solution may be boiled with excess of alkali and titrated back with acid, with or without filtration. Free acid, if present, is first neutralised by addition of alkali to the end-point indicated by helianthin. The method, which consists in precipitating the oxide, dissolving it in excess of acid, and titrating back with alkali, cannot be employed, owing to the rapid oxidation of ferrous hydroxide on exposure to air. The process may, however, be successfully applied to the sulphide, obtained by precipitation with ammonium hydrosulphide.

The indications of helianthin are wholly obscured by the presence of ferric salts, and since the latter can only exist in acid solution, titration with phenolphthalein as indicator is, alone, of no value. Ferric salts must, therefore, be reduced to the ferrous state by means of hydrogen sulphide or sodium sulphite, and one of the foregoing processes then applied.

[With DELSAUX.]—*Estimation of Copper.*—The metal is precipitated as oxide, and the washed precipitate dissolved in excess of acid and titrated back with alkali, phenolphthalein being used as indicator; or both helianthin and phenolphthalein are added to the solution, the volume of standard alkali used in passing from one end-point to the other being, as usual, equivalent to the metallic oxide in solution. Satisfactory results are obtained by either method, and the colour of the solution, even when concentrated, is found to interfere in no way with the delicacy of the titration. The precipitate of cuprous oxide obtained in saccharimetry may also be estimated alkalimetrically, a considerable saving of time being thereby effected without loss of accuracy. For this purpose, the precipitate is washed with boiling water, dissolved in nitric acid, and titrated with alkali in presence of both indicators.

[With DEMOULIN.]—*Estimation of Silver.*—The method of precipitating the oxide, dissolving the precipitate in nitric acid, and titrating back with alkali, is not to be recommended; the results obtained are too high, owing to the retention of potash by the precipitated silver oxide. Better results are got by first neutralising free acid by the addition of alkali to the end-point indicated by helianthin, adding an excess of alkali, boiling, filtering quickly, and titrating back with acid, using phenolphthalein as indicator. The end-point is not so sharp as might be wished, owing to the slight solubility of silver oxide in water. N. L.

Separation of Aluminium. By RUDOLF L. LEFFLER (*Chem. News*, 1898, **77**, 265—266).—The author finds that when a solution of aluminium chloride is boiled with sodium acetate, the aluminium is not completely precipitated, even when a large excess of acetate is used. When sufficient ammonia or sodium carbonate is added to the hot solution of chloride to cause faint opalescence, the aluminium may be completely precipitated by acetate; under these conditions, 0·25 and 0·50 gram of aluminium requires respectively 2·25 and 3·75 grams of sodium acetate for complete precipitation, and, on cooling, some aluminium is again dissolved. On account of the large excess of acetate required, aluminium cannot be separated from any other metals except manganese by this method. Nickel may be separated from aluminium by means of sodium phosphate in presence of acetic acid if an alkali is first added to the solution until it is faintly opalescent. The relative amounts of sodium phosphate and acetic acid can only be varied within narrow limits; when a solution containing 0·5 gram of aluminium and 0·1 gram of nickel per litre was treated with 30 c.c. of a saturated solution of the phosphate and 10 c.c. of acetic acid, the separation of the nickel was complete. This method does not afford a satisfactory means of separating zinc and copper from aluminium.
E. W. W.

Commercial Analysis of Bauxite. By WILLIAM B. PHILLIPS and DAVID HANCOCK (*J. Amer. Chem. Soc.*, 1898, **20**, 209—225).—The authors call attention to the importance in the analysis of bauxite of discriminating between aluminium hydroxide, which, on account of its ready solubility, is so important to alum makers, and other less soluble compounds of alumina.

The following analytical method is recommended. Two grams of the sample, which should not have been subjected to any considerable heat, is heated in a dish with 10 c.c. of sulphuric acid of sp. gr. = 1·53, until sulphuric acid fumes are evolved, when a watch glass is put on, and the heating continued for 10 minutes. When cold, 100 c.c. of hot water is added, and, after boiling for five minutes, the liquid is filtered, and finally made up to 200 c.c. For the estimation of the alumina, 50 c.c. is taken, diluted to 300 c.c., 2 c.c. of hydrochloric acid added, the liquid heated to boiling, and ammonia then added in very slight excess. After boiling for 5 minutes, the precipitate is collected, washed, dried, ignited, and weighed. From its weight is subtracted the oxides of iron and titanium obtained in other operations, and it then represents the available alumina. To estimate the titanium, 50 c.c. of the solution is neutralised with ammonia until a slight precipitate occurs, which is then carefully redissolved in sulphuric acid, after which the liquid is diluted to 400 c.c. and boiled for an hour; if iron is present, this must be reduced by continually adding sulphurous acid, and hot water should occasionally be added to replace that lost by evaporation. The titanium dioxide is completely precipitated, and can be collected, washed, dried, ignited, and weighed. The iron may be estimated in the filtrate by titration with permanganate.

In order to obtain the free alumina, 2 grams of the sample is heated with 10 c.c. of sulphuric acid of sp. gr. 1·53 at 95—100° for 1 hour in an Erlenmeyer flask having a perforated stopper, 100 c.c. of hot water is added, and after the mixture has been heated for 10 minutes, the alumina is estimated in the same way as before, but there is no necessity of looking for titanium; the small amount of ferric oxide must, however, be estimated and deducted from the weight of the alumina.

The difference between the available and the free alumina represents the combined alumina. L. DE K.

Volumetric Estimation of Cobalt. By HARRY B. HARRIS (*J. Amer. Chem. Soc.*, 1898, **20**, 173—185).—The paper is an exhaustive criticism of some of the processes in use for the volumetric estimation of cobalt.

Winkler's method, which consists in titrating the solution with standard permanganate in the presence of yellow mercuric oxide, gives fairly good results, but the author finds that it should be conducted at the boiling point of the solution. Instead of the mercury compound, a mixture of zinc oxide and ferric chloride may be used; both mercuric oxide and ferric hydroxide act mechanically on the cobaltic oxide, carrying it down, and thereby enabling the end reaction to be distinctly observed. The cobalt solution should contain about 0·1 to 0·2 gram of the metal, and comparatively small amounts of copper; ferric iron, lead, or antimony do not interfere. If arsenic is present, some ferric chloride should be added, and mercuric oxide used to carry down the cobalt. In the presence of nickel, the results are too high.

McCulloch's method, which consists in precipitating the cobalt as cobaltic cyanide, and estimating this by reducing it with ferrous sulphate, and retitrating with standard dichromate, was found to yield only 90 per cent., or even less, of the metal actually present.

Fleischer's method, which consists in oxidising an alkaline solution of cobalt and nickel with sodium hypochlorite, treating the precipitate with dilute ammonia to reduce the nickel sesquioxide, the cobaltic oxide being left unchanged, and estimating the latter by reduction with ferrous sulphate, gives utterly untrustworthy results unless the ammonia is exactly of the right strength (1 part of ammonia of sp. gr. 0·96 and 3 parts of water), and the boiling is continued for 2 hours. The amount of nickel should exceed that of the cobalt, otherwise the results may be as much as 14 per cent. too high; the best results obtained by the author still showed 2 per cent. in excess.

Donath's method consists in oxidising the cobalt with iodine in the presence of sodium hydroxide, afterwards heating the precipitate with hydrochloric acid, and estimating the liberated chlorine iodometrically; this gives fairly good results, even in the presence of nickel, but it is of prime importance that the iodine be chemically pure, otherwise part of the nickel will also be oxidised, and the result may be nearly 30 per cent. too high.

Von Reis's method, which consists in boiling the cobalt solution with zinc oxide and adding an excess of standard permanganate, which is then titrated back with ferrous sulphate, gives results which are fairly satisfactory. The author does not state whether it is influenced by the presence of nickel. In conclusion, it is stated that a really good process is still a *desideratum*. L. DE K.

Separations from Chromic Acid. IV. Separation of Chromium. By HARRY BREARLEY (*Chem. News*, 1898, **77**, 216—218. Compare this vol., ii, 409, 460).—The author finds that chromic salts may be completely precipitated in the presence of chromates by boiling with a slight excess of sodium hydroxide, or by boiling with sodium phosphate. In the latter case, the phosphate itself may be used instead of an alkali to neutralise the free acid; the chromium phosphate when precipitated in the cold is frequently of a darker colour than that obtained from hot solutions.

When chromic salts are oxidised by means of potassium permanganate, the last portions strongly resist the action of a small excess of permanganate, and, if too much of the oxidising agent is added, some chromate may be carried down by the precipitated oxides of manganese. If too little sulphuric acid is present, the precipitated manganese oxides are partly dissolved without being completely decomposed, and too much sulphuric acid prevents complete oxidation. By adding a large excess of potassium permanganate to a solution of ferrochrome or steel, the whole of the manganous salts may be precipitated.

E. W. W.

Electrolytic Estimation of Uranium and Cadmium. By EDGAR FRANCIS SMITH and DANIEL L. WALLACE (*J. Amer. Chem. Soc.*, 1898, **20**, 279—281).—Heidenreich having stated that no trustworthy results can be obtained by the authors' electrolytic process for the estimation of uranium and cadmium (Abstr., 1896, ii, 545), fresh evidence is now given in support of its accuracy.

Ten c.c. of a solution of uranium acetate containing 0·1185 gram of uranouranic oxide was mixed with 0·5 c.c. of glacial acetic acid, diluted to 40 c.c., and then electrolysed for 6 hours at 70° with a current $ND_{40} = 0·18$ ampère volt. = 3. The uranium was completely deposited as hydrated protosesquioxide, which on ignition left in 3 experiments 0·1187, 0·1184, and 0·1182 gram of uranouranic oxide.

Ten c.c. of a solution of cadmium sulphate containing 0·1656 gram of metal was mixed with excess of a solution of disodium hydrogen phosphate of sp. gr. = 1·0358 and 1·5 c.c. of phosphoric acid of sp. gr. = 1·347. After diluting to 100 c.c. and heating to 50°, the liquid was electrolysed for 7 hours with a current $ND_{100} = 0·06$ ampère volt. = 3, the current at the end of 4 hours being increased to $ND_{108} = 0·36$ ampère volt. = 7. The results in three experiments were 0·1654, 0·1658, and 0·1657 gram of cadmium. L DE K.

Coal Analysis. By WILLIAM FRANCIS HILLEBRAND, C. B. DUDLEY, and WILLIAM ALBERT NOYES (*J. Amer. Chem. Soc.*, 1898, **20**, 281—285).—This is a preliminary report from a committee appointed by the

American Chemical Society to devise uniform methods for the technical analysis of coal.

Sampling is done in the usual manner, at least five pounds of coal being employed. For the estimation of the moisture, 1 gram of the powder is heated in an open porcelain or platinum crucible for one hour at 104—107°, best in a double-walled bath containing pure toluene; it is then cooled in a desiccator and the crucible weighed covered. The process gives very concordant results, although higher and probably more correct results are obtained by drying in a vacuum over sulphuric acid; this, however, takes about 20 hours. In the case of bituminous coals, traces of volatile organic matters are driven off at 100°, particularly if dried in a current of air, but this does not materially affect the method.

To estimate the volatile combustible matter, 1 gram of the undried sample is placed in a platinum crucible weighing 20 to 30 grams and having a tightly fitting cover. This is then heated for 7 minutes over the full flame of a Bunsen burner. The crucible should be supported on a platinum triangle with the bottom 6 to 8 cm. above the top of the burner; the flame should be 20 to 25 cm. high when burning free, and the experiment made in a place protected from draught. The upper surface of the cover should burn clear, but the under surface should remain covered with carbon. From the loss on ignition must be deducted the loss on drying.

The amount of ash is estimated by incinerating the portion used for the estimation of the moisture, at first over a very low flame with the crucible open and inclined, until it is free from carbon. The fixed carbon is represented by the amount of coke less the ash.

No particular scheme is, as yet, proposed for the estimation of the sulphur, but as in the case of the other items, useful suggestions will be duly considered by the committee.

As the result of 21 analyses of coals, the heating effect of which had been determined with the bomb calorimeter, the following rule is proposed for calculating the heating effect from the analytical data. "Subtract from 100 the percentages of moisture and ash and one-half the percentage of sulphur, and multiply the remainder by 80·7. The product will be the heating effect of the coal burnt to vapour of water, expressed in calories." L. de K.

Estimation of Small Quantities of Alcohol. By Francis G. Benedict and R. S. Norris (*J. Amer. Chem. Soc.*, 1898, 20, 293—302). —The reagents required for this estimation are: A solution of chromic acid prepared by dissolving 2·2064 grams of potassium dichromate in as little water as possible, and making up to 500 c.c. with concentrated sulphuric acid, taking care that the temperature shall not rise above 100°. A standard solution of alcohol made by mixing two grams of exactly 5 per cent. alcohol in a flask with 5 c.c. of sulphuric acid, avoiding rise in temperature, and then diluting with acid to 50 c.c. Solutions of ferrous ammonium sulphate and potassium permanganate standardised against each other.

Twenty c.c. of the chromic acid solution is delivered with great care from a burette into a flask containing 200 c.c. of water, and ferrous sulphate solution is added from a burette until the chromate is entirely reduced; the unavoidable excess is titrated back with permanganate. The same amount of chromic acid solution is now mixed in a small flask with 5 c.c. of the standard alcohol and heated for 5 minutes to 98°, which temperature should on no account be exceeded; when cold, the contents are diluted with 200 c.c. of water, and the titration with iron is repeated. The difference in c.c. between the amounts of ferrous sulphate solution used to reduce the chromic acid will represent the quantity of alcohol used in the experiment.

Unknown solutions of alcohol, which are not to contain more than about 1 per cent., are first tested by specific gravity, which will give a rough indication of the percentage of alcohol. Enough of the sample is then weighed out to approximately correspond with the amount of real alcohol used in the check experiment; this is mixed with twice its bulk of sulphuric acid, 20 c.c. of the chromic acid solution is added, the whole heated to 98° as before, and after diluting with 200 c.c. of water, titrated with ferrous sulphate.

L. de K.

Estimation of Methoxy-groups. By Georg Gregor (*Monatsh.*, 1898, **19**, 116—121).—Two slight modifications in Zeisel's method are suggested. (1) The alcoholic silver nitrate solution should be strongly acidified with nitric acid, when the alkylic iodide is more readily decomposed, and the precipitate at most contains traces of silver nitrate, easily removable by water, whereas when a neutral silver solution is employed, it is always hard to remove the silver nitrate mechanically carried down by the haloid salt. (2) There is always some slight reduction of the silver nitrate solution, caused, as the author has definitely proved, by traces of the amorphous phosphorus, used to retain the evolved hydriodic acid, being carried over. This error is easily overcome by the use of a solution of arsenious acid in potassium carbonate, the former arresting any free iodine, and the latter the hydriodic acid.

A. W. C.

Solubility of Pentosans in the Reagents Employed in the Estimation of Starch. By William H. Krug and Harvey Washington Wiley (*J. Amer. Chem. Soc.*, 1898, **20**, 266—268).—In one of the processes for the estimation of starch, the material is heated under pressure with a dilute solution of lactic or salicylic acid; the authors find, however, that these liquids act on the pentosans so much, that the latter may lose from 80 to 90 per cent. of their weight, and thus cause an apparent increase in the percentage of the starch.

Contrary to König's statement, who asserts that pentosans are dissolved when using the diastase process, the authors find that pentosans are scarcely affected, so that the diastase process is the only trustworthy method for estimating starch.

L. de K.

Comparison of the Standard Methods for the Estimation of Starch. By Harvey Washington Wiley and William H. Krug (*J. Amer. Chem. Soc.*, 1898, **20**, 253—266).—The authors reject as untrustworthy the processes based on polarisation, at present in use. The method devised by Lindet, which is founded on the direct weighing of the starch after treatment with pepsin to dissolve the proteid envelope of the starch cells, is far too tedious and not very accurate, some starch remaining with the fibre, whilst, on the other hand, some fibre gets into the starch. Good results may, perhaps, be obtained by combining this method with the diastase process, but this subject is still being investigated.

The best results are obtained by the diastase process without pressure. The finely-ground sample should be thoroughly extracted with ether to remove fat, and then be treated twice with freshly prepared diastase at 50°. To make sure that all the starch has been removed, the residue should be examined microscopically for starch granules. The authors think taka-diastase may be successfully employed; it acts more slowly than ordinary diastase, but may be readily obtained free from sugars. L. de K.

Hübl's Iodine Addition Process. By J. J. A. Wijs (*Zeit. anal. Chem.*, 1898, **37**, 277—283).—Schweitzer and Lungwitz (Abstr., 1895, ii, 398) called attention to the development of acid during the action of Hübl's reagent on a fat, which acid they assumed to be hydriodic acid. The author quotes an experiment with an unnamed oil, in which, although a considerable development of acid took place, this did not liberate iodine from potassium iodate until an iodide was added, and could, therefore, not be hydriodic. He admits that the proof is imperfect, as water was added before titrating, and this produced a precipitate of mercuric iodide which may have resulted, in part, from double decomposition between hydriodic acid and mercuric chloride. He, nevertheless, advances another hypothesis, namely, that direct combination occurs between the fat and iodine chloride, which is almost certainly present in Hübl's reagent, and that the compound formed then undergoes dissociation, with separation of hydrochloric acid, and, in proof that this development of acid is the result of a mass action, he adduces experiments showing that the more free acid is present in the Hübl reagent, the less acid is developed during the iodation of a fat, although the amount of halogen absorbed is but slightly influenced thereby. Further, when equal quantities of the same specimen of reagent are caused to act on varying amounts of fat, the amount of acid developed is proportional to the amount of halogen absorbed, even when the quantity of fat is too large to be fully iodated. Fats having such widely different iodine numbers as linseed oil and cocoanut oil, show the same proportion of acid developed to total halogen absorbed, whilst substances of different constitution, such as amylic alcohol and cholesterol, show widely different proportions. Lastly, the greater the solubility of hydrochloric acid in the fat solvent, the larger is the proportion of acid developed, which fact is most in accord with the dissociation hypothesis. M. J. S.

Rancidity of Fats. By A. Schmid (*Zeit. anal. Chem.*, 1898, **37**, 301—303).—The acidity of a fat is not, as was formerly assumed, a measure of its rancidity; a fat is acid when it contains an abnormally high proportion of free fatty acids; it is rancid when the glycerol has undergone partial or complete oxidation to aldehydes and ketones. The latter may be detected by distilling the fat with steam and collecting the distillate in a flask containing a freshly prepared 1 per cent. solution of metaphenylenediamine hydrochloride, with which reagent the distillate from a rancid fat gives a yellow or yellowish-brown coloration, whilst a fresh fat gives the merest trace of yellow. Collaboration of other chemists is invited for the confirmation of this criterion of rancidity, and also for the fixation of limits. M. J. S.

Testing of Indigo. By ALBERT BRYLINSKI (*Chem. Centr.*, 1897, ii, 913—914; from *Bull. Soc. ind. Mulhouse*, **67**, 331—345).—The indigo is first sulphonated by heating 1 gram of the sample with 20 grams of powdered glass and 25 c.c. of sulphuric acid of sp. gr. = 1·85 for 6 hours at 100°; this temperature must be kept constant, otherwise compounds of a violet colour will be formed, which are not suitable for colorimetric estimation or titration. All processes based upon oxidation should be rejected, as the other constituents of the indigo are then estimated as indigo. Of methods involving reduction there are two in use, namely, the hyposulphite method and Engel's vanadium sulphate process; of these, the author prefers the latter, which is best conducted as follows: 10 grams of ammonium vanadate is dissolved in 100 grams of concentrated sulphuric acid with the aid of a gentle heat and poured into 2 litres of water at 50°. Fifty grams of zinc dust is then added, and the whole shaken until a pure, bluish-violet liquid is obtained. The analysis and the measuring off of the vanadium solution should be conducted out of contact with the air, best in an atmosphere of carbonic anhydride.

The vanadium solution is checked with a known weight of pure indigo, and is run in until the indigo solution becomes yellow, the final end-reaction being shown by a dirty-green colour. If ferric salts are present a little vanadium trioxide dissolved in sulphuric acid should be added to the indigo to reduce the iron to the ferrous state.

L. DE K.

Testing Diastatic Substances. By JOKICHI TAKAMINE (*Chem. News*, 1898, **77**, 173).—Eight glasses of 150 c.c. capacity are placed side by side in a pan of water at about 40°, into each is put 100 c.c. of starch solution, and into the first 1 c.c. of the saliva or other liquid to be tested, whilst the other seven glasses receive from 1 c.c. up to 7 c.c. of standard diastase solution; the contents are stirred, and when the liquefaction of the paste is complete, a drop from each of the seven glasses is spread on a glazed plate and treated with a drop of iodine solution giving a scale of colour with which the contents of the first tube is compared; these tests are repeated within the first 10 minutes after the addition of the saliva. The starch solution is prepared by stirring 50 grams of neutral potato starch with 200 c.c. of cold water, adding 800 c.c. of boiling water, and boiling the mixture for two minutes. For the iodine solution, 1 gram of iodine and 2 grams of potassium iodide are agitated with about 5 c.c. of water until dissolved and then diluted to 120 c.c. The standard diastase solution is made fresh each day by dissolving, in 100 c.c. of water, 1 gram of taka-diastase solution that has been standardised by Lintner's or Junk's method. D. A. L.

General and Physical Chemistry.

Phosphorescent Strontium Sulphide. By JOSÉ R. MOURELO (*Compt. rend.*, 1898, **126**, 904—906).—When phosphorescent strontium sulphide is very intimately mixed with not more than 19 times its own weight of calcium, strontium, or barium sulphate, the whole mass becomes uniformly phosphorescent when excited. Sometimes it is necessary to reheat the mixture in order to secure this result. The intensity of the phosphorescence and the excitability are lower than with the pure sulphide, and the colour of the phosphorescence is somewhat paler. The results depend on the volume of the mass; and other things being equal, the phosphorescence is most intense with barium sulphate, and least with calcium sulphate. C. H. B.

Spectra of Iodine. By HEINRICH KONEN (*Ann. Phys. Chem.*, 1898, [ii], **65**, 257—286).—A measurement of the lines in the emission and absorption spectra of iodine from $\lambda = 3030{\cdot}5$ to $\lambda = 6191$ in Ångstrom units. In vacuum tubes, either a line or a band spectrum can be obtained. The band spectrum is made up of two different parts, B_R and B_V; of these, B_R is identical with the absorption band spectrum, but B_V is not. If the discharge is sufficiently powerful, B_R disappears, whilst B_V gains in intensity, and the author is therefore inclined to assign B_R to the ordinary molecules of iodine and the occurrence of B_V to dissociation. Two series may also be distinguished in the line spectrum, but it is possible that the second series in this case is due to the presence of some impurity. The measurements are given in tabular form. H. C.

Zeeman's Phenomenon: Variations of Spectra in Magnetic Fields. By HENRI BECQUEREL and HENRI DESLANDRES (*Compt. rend.*, 1898, **126**, 997—1001).—The authors have extended the observations of Lorentz and Zeeman, Cornu and Michelson on the variations observed in spectra when the luminous bodies are within a strong magnetic field. They find that, under the influence of the field, a line may be split up in such a way that components polarised in a plane perpendicularly to the field enclose the components polarised in a plane parallel with the field, this being a mode of division which was not described by Michelson, and which is contrary to that usually observed. Special attention was given to the spectrum of iron, and the following table shows the influence of the magnetic field on a portion of the spectrum between λ387 and λ382.

	Differences of wave-length in the magnetic field; lines polarised in a plane	
Normal wave-lengths.	Normal to the field.	Parallel with the field.
3872·61	0·207	0·383
3865·65	0·368	0
3860·03	0	0·369
3858·40 (Ni)	0	0·293

Normal wave-lengths.	Differences of wave-length in the magnetic field; lines polarised in a plane Normal to the field.	Parallel with the field.
3856·49	0	0·355
3850·10	0	0
3841·19	0	0·184
3840·58	0	0·159
3834·37	0	0·230
3824·58	0	0·360
3820·64	0	0·287

It is noteworthy that the line 3850·10 does not become multiplied, although the neighbouring lines show the phenomenon. The line 3865·65 is resolved into a triplet, but, unlike other lines, it shows a distinct subdivision in the spectrum polarised in a plane normal to the field, and a slight thickening in the spectrum polarised in a plane parallel with the field.

These peculiarities show that a magnetic field may render evident differences as yet unobserved between the lines of one and the same element or between lines of the same spectrum, and the authors suggest that some of the spectral lines not hitherto recognised as belonging to any particular substance may really be due to the effects of magnetic influence.

The carbon band at λ388 found in the spectra of the sun and of comets, and remarkable for the number and regular order of its component lines, shows no recognisable splitting up or enlargement of the lines in a magnetic field, although the calcium lines, under the same conditions, show the usual subdivision. Zeeman found no alteration in the bands of iodine.

All the observations hitherto made seem to show that the influence of the magnetic field is greatest in the case of lines of high wavelength. C. H. B.

Connection between Volume Change and Specific Rotation of Active Solutions. By RICHARD PŘIBRAM and CARL GLÜCKSMANN (*Monatsh.*, 1898, **19**, 122—137, 161—170, and 171—177. Compare this vol., ii, 321).—Aqueous solutions of tartaric acid show a maximum contraction in volume at a point corresponding with about 16 per cent. of the dissolved acid; in concentrated solutions, a dilatation occurs. The specific rotation also changes with concentration in an irregular manner, several changes in the direction of the specific rotation curve occurring, and distinct breaks in continuity being observed at the concentrations 1·116, 4·669, about 16, and about 36 per cent.

In solutions of potassium tartrate, no point of maximum contraction is reached, but the contraction increases regularly with the concentration. There are three breaks on the specific rotation curve, these corresponding with the concentrations 9·03, about 17·2, and 30·84 per cent. The behaviour of sodium tartrate resembles that of the potassium salt, two breaks occurring in the specific rotation curve at 6·755 and 19·09 per cent. H. C.

Optical Activity. By L. Tchúgaeff (*Ber.*, 1898, 31, 1775—1782. Compare this vol., ii, 274).—The following numbers have been obtained for the ethereal salts of *l*-borneol with normal acids.

	$[\alpha]_D$	$[M]_D$	*d* 20°/4°	B. p. at 15 mm.
l-Borneol	−39·0°	−60·0		
Bornylic formate	−40·46	−73·6	1·0058	97°
,, acetate	−44·40	−87·0	0·9855	107
,, propionate	−42·06	−88·2	0·9717	118
,, butyrate	−39·15	−87·8	0·9611	128
,, valerate	−37·08	−88·2	0·9533	139
,, octoate	−31·45	−88·1	0·9343	175

Thus the function $[\alpha]_D$ reaches a maximum with the acetate, and then gradually diminishes, whilst the molecular rotation $[M]_D$ remains practically constant after this salt is reached.

The influence of the phenylic group on the rotation of menthol is illustrated by the following table.

	$[\alpha]_D$	$[M]_D$	*d* 20°/4°	B. p. at 15 mm.
Menthol	−50·0°	−78·0		
Menthylic benzoate	−90·9	−236·3		180°
,, phenylacetate	−69·57	−190·7	0·9874	197
,, phenylpropionate	−56·21	−161·9	0·9851	203
,, orthotoluate	−84·42	−231·3	0·9972	191
,, metatoluate	−87·94	−241·0	0·9931	197
,, paratoluate	−92·15	−252·5		200

The author compares these results with those obtained by Guye and Chavanne for the aromatic salts of *l*-amylic alcohol, and by Frankland and MacGregor for derivatives of active glyceric acid; he points out that they illustrate the moderating effect which distance from the active complex exerts on the increase of rotation produced by the phenylic group. The same influence will be recognised in the optical difference between the ethereal salts $C_5H_{11}\cdot S\cdot CS\cdot OEt$ and $C_5H_{11}\cdot O\cdot CS\cdot SEt$; the former has the specific rotatory power $[\alpha]_D = 15{\cdot}02°$, the molecular rotation $[M]_D = 28{\cdot}8°$, and a sp. gr. = 1·0184 at 20°/4°, whilst the corresponding constants for the latter salt are 6·32°, 12·1°, and 1·0167 respectively.

Amylic sulphite, $SO(O\cdot C_5H_{11})_2$, which boils at 127° under a pressure of 15 mm., has a sp. gr. 0·9841 at 20°/4°, the specific rotatory power $[\alpha]_D = 4{\cdot}03°$, and the molecular rotation $[M]_D = 8{\cdot}95°$. It conforms, therefore, to the law of superposition enunciated by Guye and Gautier (Abstr., 1895, ii, 149).

M. O. F.

Weston Standard Cell. By Ph. Kohnstamm and Ernst Cohen (*Ann. Phys. Chem.*, 1898, [ii], 65, 344—357).—The Weston standard cell, in which cadmium replaces the zinc used in cells of the Clark type, has been examined by Jaeger and Wachsmuth (Abstr., 1897, ii, 86). These authors found irregularities in the behaviour of certain of the cells dealt with between 0° and 15°, and the present investigation was undertaken for the purpose of ascertaining the cause of this peculiarity. Attention was in the first place directed to the crystallised cadmium sulphate used in the cell. As some doubt exists with reference to the composition of this salt, careful analyses were made and were found to be in agreement with the usually accepted formula, $3CdSO_4 + 8H_2O$. Solubility determinations and the investigation of some other properties of the solutions show that this salt undergoes some change at 15°, and that it is this change which affects the behaviour of the Weston cell at this temperature. The salt does not, however, appear to change in composition. For practical purposes, therefore, the use of the Weston cell should be restricted to temperatures above 15°. H. C.

A New Accumulator. By DONATO TOMMASI (*Bull. Soc. Chim.*, 1897, [iii], 17, 211—213).—The electrodes consist of a perforated tubular envelope or case of celluloid enclosing a central grid of lead-antimony alloy, the intervening space being filled with a paste of lead oxide and dilute sulphuric acid. The normal discharge varies from 1 to 4 ampères per kilogram of electrode, but may, on occasion, be increased to 12 or 15 ampères without inconvenience. The initial E.M.F. is 2·4 volts; mean E.M.F., 2 volts; capacity per kilogram of electrodes, 22—25 ampère-hours; efficiency in ampère-hours, 95 per cent.; efficiency in watt-hours, 80 per cent. N. L.

Electrical Conductivity of Dilute Solutions of Potassium Permanganate. By EMMANUEL LEGRAND (*Compt. rend.*, 1898, **126**, 1025—1027).—The molecular conductivity of potassium permanganate in aqueous solution increases with the dilution, and at 25° tends towards a limit, 124, which coincides with that obtained by other observers for normal salts at the same temperature. The resistance diminishes as the temperature rises, the rate of diminution being smaller the higher the temperature. The temperature coefficient varies but little with the dilution. C. H. B.

Galvanic Polarisation. By HANS JAHN (*Zeit. physikal. Chem.*, 1898, **26**, 385—429).—The author has repeated and extended his previous investigations on the polarisation of a cell and the energy requisite for the decomposition of the electrolyte (Abstr., 1896, ii, 230); the present values are regarded as more accurate than those previously given; this is due, chiefly, to the use of a large ice calorimeter, which renders possible more accurate measurements of the thermal changes. The values obtained are given in the accompanying table, where p_0, p_{40} are the polarisations in volts at 0° and 40°; dp/dt is the temperature coefficient of the polarisation; ω, the energy in calories necessary for the decomposition of a milligram-equivalent of the electrolyte at 20°; ω_k and ω_a, the heat developments at the cathode and anode respectively, calculated as indicated in the previous paper.

Salt.	p_0	p_{40}	dp/dt	ω	ω_k	ω_a
$CuSO_4$	1·57	1·43	−0·0038	67·77	−10·07	+21·84
$ZnSO_4$	2·62	2·48	−0·0035	115·98	−10·17	+20·06
$CdSO_4$	2·33	2·18	−0·0038	102·34	−8·77	+21·13
$Cu(NO_3)_2$	1·56	1·42	−0·0035	67·77	−10·07	+25·43
$Pb(NO_3)_2$	2·03	1·89	−0·0035	89·15	−2·43	+23·51
$Ag_2(NO_3)_2$........	1·10	0·99	−0·0028	47·30	+2·53	+28·17

It is seen that, except in the case of silver nitrate, the temperature coefficient and anodic heat are practically identical for all the salts. If the values for the cathodic polarisation be subtracted from the above polarisation values, the resulting anodic polarisations are found to be identical, within experimental error, for all the salts examined, a result which is also theoretically deduced for the salts of all strong acids; for weak acids, however, smaller values should obtain. The investigations were extended to oxy-acids, and by the thermodynamical equations deduced by the author and Schönrock (Abstr., 1895, ii, 178), the value of the polarisation E.M.F is calculated for sulphuric acid, and from this the loss of heat of the battery; the values obtained agree completely with the direct determinations. If, in the electrolysis of normal sulphuric acid, an anode of electrolytically deposited copper be employed, the total loss of heat should be equal to the difference between that due to the acid and that due to the copper sulphate, and this also was experimentally verified. According to the previous theoretical investigations, the polarisation is independent of the dissociation if the current is weak, and it was found to be so for the polarisation in phosphoric acid. The polarisation, however, being dependent on the occlusion of gas by the electrode, should vary with different electrodes, and the author found that, by the use of a mercury cathode, the polarisation in sulphuric acid reached 2·95 volts, the loss of heat being 50 per cent. greater than with the platinum cathode. In the case of the alkali salts, the polarisation should be equal for those salts the hydroxides of which are equally dissociated, and this was verified by determinations of the polarisation in solutions of sodium and lithium sulphates; ammonium sulphate, however, owing to the more feeble dissociation of the hydroxide, gave a much smaller value.

L. M. J.

Dissolving of Platinum and Gold in Electrolytes. By MAX MARGUELES (*Ann. Phys. Chem.*, 1898, [ii], **65**, 629—634).—An electromagnet with armature serves as contact breaker to the current from two Daniell cells, and between the terminals of the coil of the magnet an electrolytic cell with gold or platinum electrodes is introduced. With this arrangement, the metal can be dissolved in hydrochloric, nitric, or sulphuric acid, or in potassium or sodium hydroxide. The metals always dissolve from the electrode, which is the anode to the battery current. The solution is, however, in some way assisted by the current from the magnet, as neither a constant nor intermittent current from the battery alone is capable of effecting solution.

H. C.

Heat of Dissolution and of Dilution. By ED. VON STACKELBERG (*Zeit. physikal. Chem.*, 1898, **26**, 533—563).—The author determined the heats of dissolution and of dilution, at various concentrations, for the following compounds—potassium nitrate, chlorate, bromate, iodate, perchlorate, dichromate, and chloride, barium nitrate, ammonium chloride, sodium chloride, sodium nitrate, and cane-sugar. In most cases, the determinations were made at from 16—18°, but a few values at 0° were also obtained. With the exception of that for cane-sugar, the curves of heat of solution against concentration are all very similar, being convex to, and approaching, the axis of concentration. Between the values for N/200 and N/∞ solutions, a difference of from 5 to 15 per cent. usually occurs, except in the case of ammonium chloride, where dilution beyond N/200 has but little effect. The heat of dilution is greater at low than at high temperatures, and in sufficiently dilute solutions the same obtains for the heat of solution. The heat of dilution may be regarded as due to two causes, (1) changes in the dissociation of the dissolved compound, (2) changes in the internal pressure of the solution. The heat effects, due to the latter cause, are calculated from Tammann's results (Abstr., 1896, ii, 513) and added to those due to the dissociation, but the sum does not agree with the heat of dilution found experimentally. The temperature coefficient of both heat of dissolution and of dilution is theoretically investigated, and the results obtained are verified by the experimental values. The temperature coefficient may be also calculated from the solubility at different temperatures, and in the case of potassium chlorate the results obtained are shown to be in accord with the determinations. The case of changes in hydration of a salt is also discussed, and the author points out that the heat of hydration for $Na_2SO_4,7H_2O + 3H_2O$ must change in sign with increase of temperature, inasmuch as the solubility curve of this compound, if sufficiently produced, cuts that of the higher hydrate in two points.

L. M. J.

Heat of Neutralisation of Ethylphosphoric Acid. By G. BELUGOU (*Compt. rend.*, 1898, **126**, 1151—1152).—The heat of neutralisation of ethylphosphoric acid in dilute aqueous solution by dilute potassium hydroxide solution is, for successive equivalents +15·5 Cal., +13·8 Cal., +2·8 Cal. The corresponding values for glycerophosphoric acid are +15·4 Cal., +13·9 Cal., and +0·4 Cal., and for phosphoric acid +15·9 Cal., +11·1 Cal., and +6·6 Cal.

It follows that, in ethylphosphoric acid, it is the alcoholic function that has disappeared, whilst the strong and weak acid functions remain and correspond with those of glycerophosphoric acid. The heat of neutralisation of the weaker acid function is higher than the corresponding value for phosphoric acid.

The heat developed by the action of the third equivalent of alkali probably indicates that dipotassium ethylphosphate is partially hydrolysed in presence of excess of potassium hydroxide (compare Abstr., 1894, ii, 484, and following abstract). C. H. B.

Alkyl-Phosphoric Acids. By JACQUES CAVALIER (*Compt. rend.*, 1898, **126**, 1142—1144; see also Abstr., 1894, ii, 484).—The alkylphosphoric acids, PO_4RH_2, in which R is Et, Me, or C_3H_5 are dibasic acids, which yield normal salts, $PO_4RM'_2$, and acid salts, PO_4RHM. They are acid to methyl-orange and phenolphthalein, but the monometallic salts are neutral to methyl-orange, and the normal salts are neutral to phenolphthalein. With the latter indicator, the end-point is more distinct than with phosphoric acid. The heats of neutralisation are as follows.

		PO_4MeH_2.	PO_4EtH_2.	$PO_4(C_2H_5)H_2$.
1st equivalent......	NaOH	15·49 Cal.	15·59 Cal.	15·56 Cal.
2nd ,, ...	NaOH	14·11 ,,	13·80 ,,	14·00 ,,
1st ,, ...	KOH	15·85 ,,	15·73 ,,	—
2nd ,, ...	KOH	14·05 ,,	13·61 ,,	—
1st ,, ...	NH_3	14·36 ,,	14·44 ,,	14·24 ,,
2nd ,, ...	NH_3	12·36 ,,	12·03 ,,	12·57 ,,
1st ,, ...	$Ba(OH)_2$	15·80 ,,	16·30 ,,	15·90 ,,
2nd ,, ...	$Ba(OH)_2$	14·10 ,,	13·88 ,,	14·00 ,,

The heats of neutralisation of the three acids are practically identical. The first equivalent of alkali develops more heat than the second, and in both cases the development of heat is greater than with phosphoric acid. It follows that when an atom of hydrogen in phosphoric acid is displaced by a saturated or unsaturated alkyl radicle, it is the feeble acidic function that disappears, and there remain two acidic functions, the values of which are unequal, but are independent of the nature of the alkylic group substituted for the hydrogen. From the description of glycerophosphoric acid given by Imbert, Astruc, and Belugou, it would seem that these conclusions hold good even when the radicle substituted for hydrogen is a complex radicle containing hydroxyl groups. C. H. B.

Dialkylic Hydrogen Phosphates. By JACQUES CAVALIER (*Compt. rend.*, 1898, **126**, 1214—1215).—The dialkylic hydrogen phosphates, PO_4R_2H, when R is methyl, ethyl, or allyl, behave like strong acids, and may be accurately titrated with alkalis, either methyl-orange or phenolphthalein being used as indicator. The following heats of neutralisation were determined.

	PO_4Me_2H.	PO_4Et_2H.	$PO_4(C_3H_5)_2H$.
NaOH	15·58 Cal.	16·35 Cal.	15·12 Cal.
KOH	— ,,	16·57 ,,	— ,,
$\frac{1}{2}Ba(OH)_2$	15·91 ,,	16·76 ,,	15·58 ,,

These numbers approach those corresponding with the addition of the first molecule of base to the monalkylic dihydrogen phosphates, and are decidedly greater than those corresponding with the addition of the second molecule. In the transition from phosphoric acid to the derivatives PO_4RH_2 and PO_4R_2H, the feeblest acid function is the first to disappear. N. L.

Heat of Formation of Quinones of High Molecular Weight. By AMAND VALEUR (*Compt. rend.*, 1898, **126**, 1148—1151).—The author's results in calories are summarised in the following table.

	M. p.	Heat of combustion. Const. vol.	Heat of combustion. Const. press.	Heat of formation.
α-Naphthaquinone ...	125°	1103·4	1103·7	+46·8
β-Naphthaquinone...	114—120	1110·0	1111·3	+39·7
α-Naphthol	95	1187·6	1188·5	+30·5
β-Naphthol............	122	1189·4	1190·3	+28·7
Anthraquinone	281	1547·9	1548·5	+47·7
Phenanthraquinone	196	1547·4	1548·0	+48·2
Retenequinone	197	2156·4	2158·0	+91·4

There is a notable difference between α-naphthaquinone and β-naphthaquinone, which corresponds with the known differences between their properties, but the values for α-naphthol and β-naphthol are practically identical. The formation of naphthols from naphthalene develops more heat than the formation of phenol from benzene, and the conversion of α-naphthol into the quinone develops more heat than the corresponding change in the case of phenols containing more than six carbon atoms.

The heats of formation of the quinones throw no light on the question of their diketonic constitution. The diketones are formed from saturated hydrocarbons by elimination of $2H_2O$ and combination with O_2, but the quinones are formed from closed chain hydrocarbons by combination with O_2, and elimination of H_2O only. In this respect, it is the acids in the aliphatic series that are the analogues of the quinones, but the heat of formation of the acids from the corresponding hydrocarbons is practically independent of the molecular weight, whereas, in the case of the quinones, the heat of formation from the hydrocarbons increases distinctly with the molecular weight.

C. H. B.

Thermochemistry of Quinoneoximes. By AMAND VALEUR (*Compt. rend.*, 1898, **126**, 1205—1208).—

	Heat of Combustion. 1. At constant volume.	Heat of Combustion. 2. At constant pressure.	Molecular heat of formation.
Benzoquinoneoxime (nitrosophenol)	715·5 Cal.	715·4 Cal.	+22·9 Cal.
Thymoquinoneoxime	1334·3 „	1335·3 „	+56·2 „
α-Naphthaquinoneoxime (α-nitroso-α-naphthol) ...	1166·4 „	1166·5 „	+18·0 „
β-Naphthaquinone-β-oxime (β-nitroso-α-naphthol) ...	1170·0 „	1170·4 „	+14·4 „
β-Naphthaquinone-α-oxime (α-nitroso-β-naphthol) ...	1169·6 „	1169·7 „	+14·8 „

The differences between the heats of combustion of the quinones and of their oximes are as follows.

Benzoquinone......	656·8	Oxime	715·4	Diff.	58·6	Cal.
Thymoquinone ...	1274·6	Oxime	1335·3	„	60·7	„
α-Naphthaquinone	1103·7	Oxime	1166·5	„	62·8	„
β-Naphthaquinone	1110·3	α-Oxime	1169·7	„	59·4	„
β-Naphthaquinone	1110·3	β-Oxime	1170·4	„	60·1	„

These numbers indicate that the replacement of an atom of oxygen by the oxime group ($:N\cdot OH$) raises the heat of combustion by about 60 Cal. J. J. S.

Combination of Pyridine and Trimethylamine with Formic and Acetic Acids. By GUSTAVE ANDRÉ (*Compt. rend.*, 1898, **126**, 1105—1107).—The author has previously described the compounds of pyridine with formic and acetic acids respectively $2C_5NH_5,5H\cdot COOH$ and $2C_5NH_5,5CH_3\cdot COOH$.

The heat of the dissolution of the formic acid compound is −0·9 Cal., and the heat of neutralisation of $5H\cdot COOH$ by $2C_5NH_5$ in presence of water, is +8·3 Cal., and therefore the combination of $5H\cdot COOH$ with $2C_5NH_5$ develops +15·25 Cal. Direct determination gave +15·3 Cal. Similarly, for the acetic acid compound, the heat of dissolution is +7·85 Cal., the heat of neutralisation +7 Cal., and the heat of combination between liquid acid and liquid base +5·75 Cal. Direct determination gave +5·9 Cal.

Formic acid and trimethylamine readily combine to form a compound, $5H\cdot COOH,2NMe_3$, which boils, apparently without decomposing, at 178·5—180° under a pressure of 749·5 mm., and at 95·5 under a pressure of 16 mm. The vapour density shows, however, that the compound is completely dissociated. Acetic acid forms a similar compound not strictly analogous in composition, $4MeCOOH,NMe_3$, which boils at 150—154° under a pressure of 755·5 mm., and at 80—81° under a pressure of 37 mm., and is completely dissociated when in the form of vapour. The trimethylamine compounds seem to be somewhat more stable than the pyridine compounds, and it is noteworthy that their boiling points are distinctly higher than those of either of their respective constituents. C. H. B.

Thermochemistry of Quinoline Bases. By MARCEL DELÉPINE (*Compt. rend.*, 1898, **126**, 964—967, and 1033—1036).—

	Molecular heat of combustion.		
Base.	1. At constant volume.	2. At constant pressure.	Molecular heat of formation.
Quinoline	1122·3 Cal.	1123·0 Cal.	−32·8 Cal.
Tetrahydroquinoline	1226·56 „	1227·8 „	+0·4 „
α-Methylquinoline	1286·27 „	1287·25 „	−33·75 „
α-Methyltetrahydroquinoline	1380·56 „	1382·1 „	+9·1 „
Isoquinoline	1123·0 „	1123·7 „	−33·5 (solid)
Hydroisoquinoline	1213·75 „	1215·0 „	+13·2 (liquid)

The following are the data for the hydrochlorides, the corresponding numbers are also given for aniline in order to compare with those of the quinoline bases; and the numbers for benzylamine and methylaniline are given for comparison with those of the isoquinoline bases.

	Heat of saturation.				Heat of solution of the hydrochloride (1 mol. = 4 litres).
	Bases.				
	HCl dissolved.	Salt dissolved.			
Base	HCl = 4 litres.	2HCl = 6 litres.	HCl gas.	All dissolved.	
Quinoline, anhydrous ...	6·46 Cal.	6·58 Cal.	26·80 Cal.	5·46 Cal.	− 2·95 Cal.
,, $(+1·5H_2O)$ ...	5·23 ,,	—	—	—	—
Hydroquinoline	7·15 ,,	7·25 ,,	28·05 ,,	—	− 3·50 ,,
α-Methylquinoline	8·80 ,,	8·85 ,,	28·10 ,,	—	− 1·90 ,,
α-Methylhydroquinoline	8·45 ,,	8·50 ,,	27·85 ,,	—	− 2·0 ,,
Aniline	7·44 ,,	8·34 ,,	27·57 ,,	7·44 ,,	− 2·73 ,,
Isoquinoline (liquid) ...	6·35 ,,	6·4 ,,	27·0 ,,	—	− 3·25 ,,
,, (solid)	5·01 ,,	—	25·66 ,,	—	—
,, (hydrate)	5·41 ,,	—	—	—	—
Hydroisoquinoline (liq.)	12·93 ,,	—	34·29 ,,	9·92 ,,	− 3·96 ,,
Benzylamine (liq.)	15·46 ,,	—	36·69 ,,	12·90 ,,	− 3·83 ,,
Methylaniline (liq.)......	6·9 ,,	8·2 ,,	24·3 + D	—	− D

Quinoline bases.—

C_9H_7N liq. + water = C_9H_7N diss. .... + 1 Cal.
C_9H_7N liq. + $1·5H_2O$ = $C_9H_7N,1·5H_2O$ liq. ... + 1·23 Cal.
$C_9H_7N,1·5H_2O$ + water = C_9H_7N diss. .... + 0·23 Cal.
C_9H_7N liq. + $2H_2$ gas = $C_9H_{11}N$ liq. .... + 2 × 16·6 Cal.
$C_{10}H_9N$ liq. + $2H_2$ gas = $C_{10}H_{13}N$ liq. .... + 2 × 21·5 Cal.

Isoquinoline.—C_9H_7N liq. + $2H_2$ gas = $C_9H_{11}N$ liq ...... + 2 × 23·5 Cal.

J. J. S.

Atomic Weights by Physical and Chemical Methods. By Daniel Berthelot (*Compt. rend.*, 1898, **126**, 1030—1033).—The atomic weights of hydrogen, nitrogen, oxygen, and carbon deduced from molecular volumes and relative densities (next abstract) are almost identical with the best determinations by chemical methods.

	O.	H.	N.	C.
Physical method	16	1·0074	14·007	12·007
Chemical method......	16	1·0023—1·0075	14·012	12·001—12·005

It follows that the atomic weights deduced simply from determinations of relative density and compressibility confirm the results obtained by chemical methods, and in some cases are the more accurate of the two.

C. H. B.

Molecular Weights of Gases. By Daniel Berthelot (*Compt. rend.*, 1898, **126**, 954—956).—In consequence of the differences between the coefficients of expansion and compressibility, the molecular weights of gases are proportional, not to the actual density, but to the product of this value into the molecular volume. The molecular volume of a gas is given by the formula $v_0 = v\frac{p}{p_0}[1 + a(p - p_0)] = v\frac{p}{p_0}(1 + ap - ap_0)$, where v is the actual volume under an infinitely small pressure p, whilst p_0 is the normal pressure and a is a coefficient which, according to Regnault, is constant between 1 atmos. and 6 atmos., and which, in the light of Amagat's experiments, may be assumed to hold good between 1 atmos. and 0 atmos. If p is infinitely small, and p_0 is one atmosphere, the relation between the molecular volumes of two gases is given by the expression $v_0/v'_0 = (1 - a) \div (1 - a')$. If d and d' are their respective densities, their molecular weights are proportional to $(1 - a)d$ and $(1 - a')d'$.

The following table gives (1) the value of a at 0°; (2) the molecular volume v_m at 0° and atmospheric pressure; (3) the sp. gr. d with reference to oxygen as a standard; (4) the molecular weight M when $0 = 32$, and (5) the atomic weight μ when $0 = 16$.

	H.	N.	CO.	O.
a	−0·00046	+0·00038	+0·00046	+0·00076
v_m	1·00046	0·99962	0·99954	0·99924
d	0·062865	0·87508	0·87495	1
M	2·01472	28·0132	28·0068	32
μ	1·0074	14·007	12·007	16

C. H. B.

Determination of the Molecular Weight of Solid Substances. By ANDREAS FOCK (*Ber.*, 1898, **31**, 1610—1611).—A reply to I. Traube (this vol., ii, 369). M. O. F.

Molecular Association of Liquids. By WILHELM VAUBEL (*J. pr. Chem.*, 1898, [ii], **57**, 337—356).—The molecular association of liquids can be easily determined by dividing the actual heat of vaporisation by the heat of decomposition, the latter standing in direct relation to the atomic or molecular weight. The result so obtained is the number of molecules or atoms, which have been separated from one another during the passage into a state of vapour, and by adding one to the quotient the true amount of molecular association is obtained for the average number of molecules.

The molecular weight of solids cannot be determined in a similar manner by making use of the heat of liquefaction, because the amount of work necessary to overcome the force of cohesion or molecular dissociation cannot be determined.

The author's experimental results are arranged in three tables, the first dealing with elementary substances, the second with inorganic compounds, and the third with organic compounds. The author concludes that his numbers agree sufficiently with those obtained by previous observers to warrant the use of his method. A. W. C.

Mutual Solubility of Liquids and the Critical Solution Point. By VICTOR ROTHMUND (*Zeit. physikal. Chem.*, 1898, **26**, 433—492).—The author first gives a summary of the work of previous observers, more especially of Abascheff, Alexéeff, and Guthrie. In his own researches, he employed the synthetical method used by Alexéeff, that is, the determination of the temperatures at which mixtures of known composition become turbid on cooling and clear on heating; in almost all cases, the two temperatures lie within 0·2°, so that no supersaturation effects appear to occur. The pressure, being the vapour pressure of the liquids employed, was not constant, but the errors introduced are quite inappreciable. For most of the pairs of liquids examined, the curves were similar to that obtained by Alexéeff for phenol and water, and the following critical temperatures were obtained; phenol–water, 68·9°; propionitrile–water, 113·2°; furfuran–water, 122·5°; acetylacetone–water, 87·25°; isobutyric acid–water, 24·3°; hexane–methylic alcohol, 42·8°; methylic alcohol–carbon bisulphide, 39·9°; resorcinol–benzene, 109°. In the case of an alcoholic mixture, it is essential that the alcohol employed be absolutely free from moisture. For a mixture of methyl ethyl ketone and water, a critical temperature of about 151° was obtained, and here a minimum and maximum occur in the lower and upper branches respectively of the concentration | temperature curve so that a closed curve is indicated. With diethyl ketone and water, the critical point was not reached, but here also a minimum is found. In the case of a mixture of triethylamine and water, the author verifies Guthrie's determination of a lower critical point, that is, a temperature *below* which two liquid layers do not exist (*Phil. Mag.*, 1884). The form of the curve is normal, and differs from that given by Guthrie, which is impossible, and, contradictory to his statements. No upper critical point was reached. A lower critical point also occurs at about 6·5° in the case of β-collidine and water, and here, although the upper point was not reached, its existence was indicated by a maximum and minimum on the branches of the curve. It appears very probable, therefore, that the general form of the complete mutual solubility curve is a closed curve. If the osmotic or partial pressure of a component, and the reciprocal of its concentration, be taken as pressure and volume co-ordinates, the form of the isothermals are completely analogous to those of a liquid and its vapour, and the thermodynamics of the latter case may be applied. The diameter of the solubility curve is a straight line, that is, if C_1, C_2 be the concentrations of a component in the two layers, then $C_1 + C_2 = A + Bt$, a further analogy to ordinary critical phenomena. The author does not find, however, that Van der Waals' law of corresponding states is obeyed, whether the concentration is calculated by weight or by volume. In the case where one of the components is a solid, its solubility curve may or may not cut the mutual solubility curve of the liquids, and only in the former case can fusion under the solvent take place. The author classifies the liquids examined with regard to the mutual solubility, and the order of the list appears to indicate some connection between this property and the dielectric constants of the liquids. L. M. J.

Diffusion of Solids in Gases. By Albert Colson (*Bull. Soc. Chim.*, 1897, [iii], 17, 164—165).—When a slow current of sulphurous anhydride is passed over lead dioxide, a deposit of lead sulphate soon makes its appearance on the walls of the tube, showing that the gas has penetrated the solid, and also that the solid has diffused through the gas. The spreading of metallic copper on the surface of the glass, when the oxide is reduced in a current of hydrogen, appears to be a phenomenon of the same kind. The experimental conditions seem to preclude the explanation of the facts by the successive formation and decomposition of easily dissociable compounds. N. L.

Semi-permeable Membranes. By J. MIJERS (*Rec. Trav. Chim.*, 1898, 17, 177—181).—According to Ostwald, a semi-permeable membrane is both a conductor like metals and also an "ion sieve"; experiments made by the author, however, are not in accordance with the latter idea. The copper deposited on semi-permeable membranes is not a coherent mass, but is more of a spongy nature. A glass cylinder, closed by a membrane of copper ferrocyanide on parchment paper and filled with normal copper sulphate solution, is placed in an electrolysing vessel containing the same solution, and a current from two Bunsen's elements passed through; no copper is deposited on the membrane during the first half-hour, and it is only as the liquid in the cylinder is becoming colourless that the deposit is formed. If the cathode, which is placed in the cylinder closed by the membrane, is weighed both before and after the experiment, it is found that the amount of copper deposited exceeds by a considerable amount that previously contained in the solution in the cylinder, thus indicating that copper must have passed through the membrane. If acidified water and a platinum cathode are placed in a similar cylinder closed by a membrane, and this is then placed in an electrolytic vessel containing copper sulphate, even after a few minutes metallic copper is deposited on the cathode; the amount of this copper, after 4 hours, is more than 100 times that contained in the precipitate of copper ferrocyanide on the membrane, which is not acted on by the acid and retains its colour.

Experiments have also shown that semi-permeable membranes are conductors differing entirely from metals. For example, if the anode and cathode in a copper sulphate electrolysis apparatus are separated by a semi-permeable membrane fixed between two ebonite rings and by a sheet of platinum of exactly the same size as the membrane, when the current passes, no metal is deposited on the membrane, but it is on the platinum, especially near the middle, none, however, near the margin, which is protected by the ebonite. J. J. S.

Influence of Temperature on Chemical Reactions. By ALBERT COLSON (*Compt. rend.*, 1898, 126, 1136—1138).—Although dry silver phosphate and pyrophosphate are not attacked by dry hydrogen sulphide at 0°, the action becomes distinct at 15° to 20°, and rapid at 100°. Dry zinc phosphate is not appreciably attacked between 5° and 9°, but the action becomes marked at 100°, and rapid at 160°. Experiments at 100° show that the mass of hydrogen sulphide decomposed by zinc phosphate in unit time and at a constant temperature is proportional to the square of the pressure.

Dry cupric phosphate and orthophosphate, on the other hand, absorb hydrogen sulphide slowly but continuously at 0°. The rate of the reaction is greatly reduced if the pressure is lowered, but is accelerated by a rise of temperature.

The decomposition of silver phosphate or pyrophosphate by hydrogen sulphide develops more heat than the decomposition of the corresponding cupric salts, and hence there seems to be no connection between the heat of decomposition and the temperature at which the reaction will take place. C. H. B.

Effect of Catalytic Action on the Velocity of Oxidation of Sodium Sulphite by Atmospheric Oxygen. By SAMUEL L. BIGELOW (*Zeit. physikal. Chem.*, 1898, **26**, 493—532).—If a solution of sodium sulphite be oxidised by drawing through it a current of atmospheric air, the velocity of oxidation is greatly reduced by the presence of small quantities of organic compounds in the solution, and this retarding influence was examined as far as possible quantitatively. Very great difficulty was experienced in obtaining comparable results, as differences frequently occurred when the conditions were apparently identical; and although many sources of error were traced, *e.g.*, indiarubber connection in the air passages, storage of water in different vessels, yet when all those known are avoided, a series of experiments are only comparable when an initial and final experiment, under similar conditions, give the same result. Very small quantities of the catalytic agent can be then detected, thus mannitol affects the velocity when present in N/320000 solution, whilst benzaldehyde has an even more marked effect. Experiments with N/500 sodium sulphite solution, and air velocities varying from 0·5 to 4·7 litres per minute, proved that the initial velocity of oxidation is proportional to the air velocity, and that, with an exception in the case of the slowest current, the quantity of air necessary for the oxidation of 50 per cent. of the sulphite is independent of the velocity. The air velocity, however, appears to have but a slight influence when the reaction takes place in the presence of a retarding catalytic agent, so that the influence of the latter is not on the dissolution velocity of the oxygen, but on the reaction velocity $Na_2SO_3 + O \rightarrow Na_2SO_4$. With solutions of sodium sulphite of very different strengths, the curves representing concentration | time are in all cases straight lines until a concentration of about N/500 is reached, when they rapidly bend downwards, indicating a marked decrease in the velocity. This is explained by the assumption of a great velocity constant for the reaction itself, so that until the concentration is small, the oxygen is removed from solution more rapidly than it is dissolved. The retarding effect of various compounds was determined, and experiments with mannitol, ethylic alcohol, and glycerol showed that the influence is accurately additive. In the monhydric, fatty alcohols, the retardation increases slightly with the molecular weight, but this may possibly be due to their lower volatility and removal by the air current; normal and isobutylic alcohols have equal effects; that of the secondary compound is greater, and that of the tertiary almost negligable. Allylic alcohol has a greater effect than propylic alcohol, but no other comparison of saturated and unsaturated compounds was made. In the aromatic series, benzylic alcohol has an enormous effect, being the most active compound examined, its presence in N/8000 solution reducing the amount of sodium sulphite oxidised in 30 minutes from above 90 to 3 per cent.; most aromatic compounds have also great influence. The fatty aldehydes have little effect, and the ketones and ethereal salts practically none. Oxalic acid, carbonic anhydride, and ozone accelerate the velocity; sodium hydroxide has very little effect.

L. M. J.

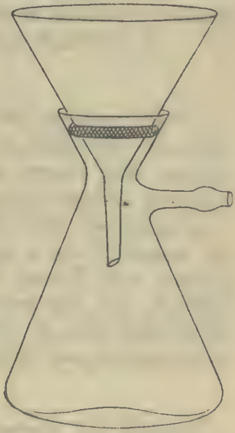
Causes of the Reciprocal Displacements of Two Acids. By Albert Colson (*Compt. rend.*, 1898, **126**, 831—833).—When dry hydrogen sulphide is brought in contact with silver phosphate, the gas is at first absorbed somewhat rapidly, then more slowly, and finally a condition of equilibrium is reached in about 3 days, the pressure of the residual gas being 125 mm. at 12°; the equilibrium is not appreciably affected by increasing the pressure of the gas, but is at once disturbed by a rise of temperature. At 109°, the reaction rapidly becomes complete.

Similar phenomena were observed with silver pyrophosphate; the higher the temperature, the greater the amount of change before equilibrium is established, and the lower the pressure of the residual gas.

The reaction between a chloride and a non-volatile acid is endothermic, and that between metallic salts and hydrogen sulphide is exothermic, but in both cases a rise of temperature promotes the reaction and a fall of temperature retards it. It would seem, therefore, that temperature is the principal factor in reciprocal displacements of this kind. C. H. B.

A Fractionating Apparatus. By A. Tixier, Chenal-Ferron-Douilhet and Co. (*Bull. Soc. Chim.*, 1897, [iii], **17**, 392—395).—This somewhat complex apparatus, of which a sketch is given, consists of two parts: the analyser, formed by a bulbed tube, and the refrigerator, which is a small, subsidiary condenser. The latter effects the more or less complete condensation of the vapours from the boiling liquid, the distillation of these condensed vapours being then brought about by those subsequently formed. N. L.

A New Filter Flask. By Reinhold Walther (*J. pr. Chem.*, 1898, **57**, 544—545).—The construction of this flask is easily understood from the accompanying drawing. Into the funnel-shaped neck of the flask is placed an ordinary funnel, the junction being made air-tight by means of a rubber ring, which is suitable for all sized funnels and flasks. The fitting up of the flask, as well as the removal or change of funnel, is thus much simplified. A. W. C.



Inorganic Chemistry.

Formation of Iodates from Iodides. By Georg Kassner (*Arch. Pharm.*, 1898, **236**, 165—172).—Although potassium iodide is easily oxidised to iodate when warmed with nitric acid in an open vessel, it is not changed when heated with the acid in a sealed tube at

150—200°; this is accounted for by the reducing action of the nitrous acid initially produced, which is not removed from the sphere of action.

Similarly, although potassium iodide is readily converted into iodate by aqueous potassium permanganate, it remains unaffected in presence of an alkaline solution of potassium ferricyanide; this is probably due to a reverse change taking place, which involves the reduction of potassium iodate by potassium ferrocyanide. Such a change can, however, be prevented by removing the iodate as an insoluble precipitate at the moment of its formation. Thus, when a solution containing potassium iodide, potassium ferricyanide, and barium and potassium hydroxides in the proportions of the equation

$$12K_3FeC_6N_6 + 2KI + 10KOH + Ba(OH)_2,8H_2O = Ba(IO_3)_2 + 12K_4FeC_6N_6 + 14H_2O,$$

is left during several hours, 75 per cent. of the iodide is oxidised, and precipitated as barium iodate; the latter, however, generally contains a considerable proportion of barium carbonate and traces of iron, but can be easily purified by washing it successively with dilute potash and nitric acid. If, in the above method, iodine is made the starting point instead of potassium iodide, the proportions which give the best results are those corresponding with the equation

$$I_2 + 10K_3FeC_6N_6 + 10KOH + Ba(OH)_2,8H_2O = Ba(IO_3)_2 + 10K_4FeC_6N_6 + 14H_2O.$$

W. A. D.

Combination of Ammonium Nitrate with Ammonia. By EDWARD DIVERS (*Zeit. physikal. Chem.*, 1898, **26**, 430—432).—The author had shown in 1873 (*Phil. Trans.*, **163**, 359) that dry ammonium nitrate absorbs ammonia and liquefies, behaving similarly to a deliquescent salt in a moist atmosphere, and that the product may be regarded as a true solution of ammonium nitrate in ammonia. Raoult and Troost, however, considered a definite compound to be formed, and the author therefore points out that Kuriloff's recent work (this vol., ii, 156) is in complete accord with his own early investigations, and indicates the absence of any chemical compound.

L. M. J.

Action of Oxygen on Carbon Bisulphide under the Influence of Light. By MARCELLIN P. E. BERTHELOT (*Compt. rend.*, 1898, **126**, 1060—1066).—A mixture of air and carbon bisulphide vapour may be exposed to diffused daylight for a year without any change taking place, but if exposed to bright sunlight, some reaction takes place in an hour or two, and a yellowish-white substance is deposited which contains sulphur, carbon, and oxygen, whilst carbonic oxide and carbonic anhydride are also formed, and remain mixed with the residual oxygen and the nitrogen. No nitrogen enters into combination, and in this respect the action of light differs from that of the silent electric discharge.

The most important point about the reaction is that the light has no effect until it reaches a certain and somewhat high intensity; it is, therefore, analogous to the many reactions that do not take place below a particular temperature.

C. H. B.

Derivatives of Silicon Tetrachloride. By JOSEPH F. X. HAROLD (*J. Amer. Chem. Soc.*, 1898, **20**, 13—29).—The author finds that silicon tetrachloride does not act on the following substances, formonitrile, acetonitrile, propionitrile, succinonitrile, benzonitrile, toluonitrile, nitric peroxide, the mixed vapours of nitric peroxide and chlorine, the chlorides of phosphorus, sulphur monochloride, or cyanogen chloride. When silicon tetrachloride is heated with mandelonitrile or lactonitrile, silicic acid and complex tarry products are formed. By the action of aniline (4 mols.) on silicon tetrachloride (1 mol.) dichlorosilicondianilide, $SiCl_2(NHPh)_2$, and aniline hydrochloride are obtained. The violence of the action is moderated by using anhydrous ether or benzene; in the former case, both products are precipitated; in the latter, the silicon compound remains in solution. According to the author, in the longer and less direct method of Reynolds (Trans., 1889, **55**, 474) a further reaction between dichlorosilicondianilide (1 mol.) and aniline (4 mols.) takes place, whereby silicontetranilide, and aniline hydrochloride are formed. Silicon tetrachloride acts on orthotoluidine more readily than on aniline, the action taking place even in a freezing mixture, the products being analogous to those obtained in the case of aniline. When silicon tetrachloride vapour is passed into molten benzamide, benzaldehyde is formed, whilst with acetamide, the tetrachloride yields acetonitrile. E. W. W.

Method of Preparing Metals and Alloys by means of Aluminium. By HANS GOLDSCHMIDT (*Annalen*, 1898, **301**, 19—28).—Since the discovery of a method of preparing aluminium in large quantities, advantage has been taken of the reducing action of this metal towards metallic chlorides and oxides. In many cases, the action is so violent that only small quantities of material can be dealt with conveniently. By avoiding the application of external heat, however, the author has found that the change may be kept under control, sufficient heat to start the interaction being supplied at a point in the mixture by means of ignited magnesium ribbon. The best results are achieved when several kilograms of material are manipulated at one time.

In this way, a large number of metals, even those which are not readily fusible, may be prepared without difficulty; if a small excess of the oxide is employed, the metal is obtained uncontaminated with aluminium. Chromium and manganese have been prepared in a very pure condition; the latter metal exhibits surface colours, and has greater cohesive power than when produced by the ordinary method.

The sulphides of the metals may be advantageously used in place of the oxides; in this case, the temperature of reaction is lower.

M. O. F.

Metallic Precipitation. By JEAN B. SENDERENS (*Bull. Soc. Chim.*, 1897, [iii], **17**, 271—286. Compare Abstr., 1897, ii, 171, 319, and 448).—The action of metals on solutions of metallic nitrates having been dealt with in former communications, the author now gives the results of further experiments on the action of various metals on the sulphates, chlorides, and acetates of silver, copper, and lead. The substances used were chemically pure, and the experiments were carried out in neutral solutions at the ordinary temperature, with exclusion of air.

The nature of the acid radicle of the salt appears to exercise a marked influence on the precipitation. Thus, tin and iron precipitate silver and copper from their sulphates, but have no action on the acetates; bismuth, on the other hand, precipitates silver acetate, but not the sulphate. Aluminium completely precipitates silver sulphate, but has scarcely any action on silver acetate; it acts rapidly on cupric chloride, very slowly on cupric sulphate, and still more slowly on the acetate. In many cases, the rapidity and character of the precipitation varies with the concentration of the solution. It is remarkable that nickel has no action on the salts examined, with the exception of a very limited reaction in the case of cupric chloride, whereas cobalt brings about immediate precipitation.

As a general rule, the amount of the precipitating metal which enters into reaction is greater than that accounted for by the equation $R''SO_4 + M'' = M''SO_4 + R''$, owing to the occurrence of various secondary reactions. Sometimes, as with zinc and aluminium, hydrogen is evolved and the precipitating metal is converted into a basic salt; sometimes, as in the cases of tin and bismuth, an acid salt remains in solution whilst an oxide or a basic salt is precipitated. In almost every case, the precipitated metal is contaminated more or less with the precipitating metal, a definite alloy being formed by the action of cadmium on silver salts (this vol., ii, 25). Zinc alone, acting on a solution of lead acetate, appears to give a precipitate of pure metal.

N. L.

Action of Calcium Sulphate on Halogen Alkali Salts. By ALFRED DITTE (*Compt. rend.*, 1898, **126**, 694—700).—In dilute solutions, the decomposition of calcium chloride by alkali sulphates would be slightly endothermic (– 0·9 Cal.), and hence, under these conditions, calcium sulphate should decompose alkali chlorides.

When calcium chloride and potassium sulphate solution interact in presence of potassium chloride solution, there is no apparent change so long as the proportion of calcium chloride remains below a certain limit, but if this limit is exceeded, slender, transparent, brilliant needles of the double sulphate, $CaSO_4,K_2SO_4 + 4H_2O$, are gradually deposited. It is obvious that the formation of this double salt may serve to change the thermal sign of the reaction. The salt readily forms supersaturated solutions; analyses of the solution after equilibrium has been attained consequent on each fresh addition of calcium chloride show that the higher the proportion of calcium remaining in the solution, the lower the proportion of sulphuric acid, and *vice versâ*. Numbers are given showing the conditions of equilibrium at 24° in a solution containing 120 grams of potassium chloride per litre.

On the other hand, when calcium sulphate is in contact with potassium chloride solutions of increasing concentration, the proportions of calcium and sulphuric acid dissolved at first increase with the quantity of potassium chloride, and the relative proportions indicate that the calcium sulphate dissolves unchanged. Beyond a certain point, however the quantity of calcium dissolved continues to increase, but the quantity of sulphuric acid dissolved reaches a maximum and then decreases; at the same time, the crystals of the double sulphate gradually separate. If the quantities of potassium chloride are represented by the abscissæ, and the quantities of either calcium or sulphuric acid in the solution are represented by ordinates, regular curves are obtained, that of the calcium being first concave and afterwards convex towards the horizontal axis. The curve of sulphuric acid reaches a maximum and then descends, the points of inflexion of the two curves falling on the same ordinate. It is clear, therefore, that, whilst under certain conditions potassium sulphate can decompose calcium chloride, under other conditions the reverse change takes place and the formation of the double sulphate, and the proportion of potassium chloride present, are important factors in the establishment of equilibrium.

With potassium or calcium bromide, the phenomena are practically the same as with the respective chlorides, and the iodides behave similarly.

With ammonium chloride and sodium chloride, the results are also similar, except that no formation of a double sulphate takes place.

C. H. B.

Action of Strontium Chromate on Mercuric Chloride. By H. Imbert and G. Belugou (*Bull. Soc. Chim.*, 1897, [iii], 17, 471—473).—One hundred and two grams of strontium chromate are dissolved in 50 c.c. of concentrated hydrochloric acid, and the solution diluted with water to 250 c.c.; 271 grams of mercuric chloride are then dissolved in the liquid, which is warmed on the water bath, filtered, and allowed to cool. Orange-red crystals separate, which, on drying over sulphuric acid, have the composition $SrCrO_4,2HgCl_2,HCl$. The compound is not decomposed by water.

N. L.

Action of Strontium Chromate on Mercuric Chloride. By G. Belugou (*Bull. Soc. Chim.*, 1897, [iii], 17, 473—474).—20·4 grams of strontium chromate, 27·1 grams of mercuric chloride, and 200 c.c. of water are heated together on the water bath, the liquid being finally filtered from the insoluble reddish residue, which probably contains basic mercuric chromate. The filtrate, on cooling, deposits orange-yellow crystals, which, when dried over sulphuric acid, have the composition $2(SrCrO_4,3HgCl_2),HCl$.

N. L.

Dissociation of Barium and Manganese Carbides. By Gin and Leleux (*Compt. rend.*, 1898, 126, 749—750).—When barium or manganese carbide is heated in an electric furnace with a current of 35 volts and 16 ampères per sq. cm., it dissociates into the metal, which volatilises, and carbon which remains in the form of graphite. The barium compound dissociates more readily than the manganese compound, but both decompose below the volatilising point of carbon. (Compare this vol., ii, 322.)

C. H. B.

Preparation of Beryllium by Electrolysis. By Paul Lebeau (*Compt. rend.*, 1898, 126, 744—746).—Beryllium fluoride, like the other haloid salts, is a non-conductor of electricity when fused, but becomes a conductor and electrolyte when mixed with an alkali fluoride. The beryllium sodium fluorides, BeF,2NaF and BeF,NaF, are most readily prepared by dissolving the necessary quantities of beryllium hydroxide and sodium carbonate in hydrofluoric acid; the first melts at about 350°, and the second at a red heat. The fused salt is electrolysed in a nickel crucible, which serves as the cathode, whilst the anode is a rod of graphitic carbon. When the current passes, the source of heat is withdrawn; the salt remains fused, and it is important that the temperature should never exceed an incipient red heat. A current of 6 to 7 ampères and 35 to 40 volts is sufficient, and the metal separates in a crystalline form.

Alloys of beryllium can be obtained by conducting the electrolysis in a carbon crucible, which serves as the anode, and contains the other metal in a state of fusion. C. H. B.

Attempts to prepare Hydrated Double Chloride or Bromide of Sodium and Magnesium. By AUGUSTE DE SCHULTEN (*Bull. Soc. Chim.*, 1897, [iii], **17**, 169—170).—Attempts to prepare the double chloride, $NaCl,MgCl_2 + H_2O$, described by Poggiale, were unsuccessful. The corresponding double bromide also appears to be incapable of existence. N. L.

Production of Brominated Potassium and Ammonium Carnallites. By A. DE SCHULTEN (*Bull. Soc. Chim.*, 1897, [iii], **17**, 167—169).—Substituted carnallites of the formulæ $KBr,MgBr_2 + 6H_2O$ and $NH_4Br,MgBr_2 + 6H_2O$ are formed when solutions of the mixed salts are slowly evaporated over sulphuric acid; a large excess of the magnesium salt must, however, be employed. The crystallographic characters and optical properties of the salts are described. The double salt obtained by Löwig, and stated by him to have the formula $2KBr,MgBr_2 + 6H_2O$, could not be prepared; nor could the corresponding double chloride. The product obtained by Löwig was probably a mixture of potassium bromide with brominated carnallite. N. L.

Attempts to Produce Compounds Isomorphous with Kainite and with Tachyhydrite. By A. DE SCHULTEN (*Bull. Soc. Chim.*, 1897, [iii], 17, 165—167).—Experiments were made with a view to ascertain whether the methods which have been successfully employed for the synthesis of kainite, $K_2SO_4,MgSO_4,MgCl_2 + 6H_2O$, and tachyhydrite, $CaCl_2,2MgCl_2 + 12H_2O$, could be used for the production of isomorphous compounds of the formulæ $(NH_4)_2SO_4,MgSO_4,MgCl_2 + 6H_2O$, $K_2SO_4,MgSO_4,MgBr_2 + 6H_2O$, and $CaBr_2,2MgBr_2 + 12H_2O$. Such compounds appear, however, to have no existence. N. L.

Double Haloid Salts of Lead and Ammonium. By H. FONZES-DIACON (*Bull. Soc. Chim.*, 1897, [iii], **17**, 346—356).—According to Remsen, the number of molecules of an alkali haloid which combines with a molecule of a metallic haloid is never greater, and is usually less, than the number of halogen atoms contained in the latter. It is admitted, however, that the compounds containing ammonium haloids often form exceptions to this rule, and, not being satisfied with the explanations of this fact usually offered, the author has made a complete study of all the compounds to be obtained by the action of solutions of ammonium haloids on lead haloids. The latter are dissolved by hot solutions of the ammonium salts, and, on cooling, the solutions deposit the double salts, the composition of which depends on the experimental conditions. Since these compounds undergo dissociation in aqueous solution, the crystals must be washed with a dilute solution of the ammonium haloid used in their preparation. The analysis of these salts is carried out as follows: the lead is converted into lead sulphate, ammonium sulphate being expelled by heating to redness; the ammonia is distilled and titrated; the halogens are calculated from the weight of mixed silver salts into which they are converted, combined with a volumetric determination of the amount of silver required to combine with them. The following new compounds are described.

Salts of the type MX_3A.—$Pb(ClI_2)NH_4 + 2H_2O$; $Pb(BrI_2)NH_4 + 2H_2O$.

Salts of the type MX_4A_2.—$Pb(Cl_2Br_2)(NH_4)_2 + 4H_2O$; $PbBr_4(NH_4)_2$.

Salts of the type M_2X_5A.—$Pb_2(Cl_4Br)NH_4$; $Pb_2(Br_4Cl)NH_4$; $Pb_2Br_5NH_4$; $Pb_2(BrI_4)NH_4$.

Salt of the type $M_3X_{10}A_4$.—$Pb_3I_{10}(NH_4)_4 + 6H_2O$.

No double fluoride could be prepared; the action of ammonium bromide on lead fluoride gave rise to the compound PbFBr, analogous to the compound PbFCl previously obtained by Berzélius.

All these substances are well-defined crystalline compounds which are decomposed by water, but are dissolved by caustic potash and by strong acids. In every case, Remsen's law holds good, and no evidence could be found for the existence of the complex salts, probably mixtures, described by Woelckel, Poggiale, and André, and which have been cited as exceptions to the law. N. L.

Double Thiosulpates of Copper and Potassium. By Wilhelm Muthmann and L. Stützel (*Ber.*, 1898, **31**, 1732—1735).—*Potassium cuprithiosulphate*, $Cu(S{\cdot}SO_3K)_2$, is obtained by mixing solutions of potassium thiosulphate and copper sulphate, the blue colour of the latter salt being changed to pale yellow; it forms slender, colourless needles, and if allowed to remain in contact with the mother liquor for several days, becomes brown from the separation of cupric sulphide. The salt is probably identical with the compound described by Cohen (Trans., 1897, **51**, 38), who gave to it the formula $Cu_2S_2O_3,2K_2S_2O_3$; apart from analysis, however, its behaviour accords more closely with that of a cupric compound. Caustic soda produces a very faint turbidity in the aqueous solution, whilst the solid substance, on digestion with the agent, yields black copper oxide; potassium ferrocyanide gives the characteristic reddish-brown cupric ferrocyanide, and hydrogen sulphide produces colloidal cupric sulphide, which is precipitated by acids and neutral salts. From the behaviour of the salt towards caustic soda and ammonia, which does not develop colour, the authors regard it as having the above constitution, rather than that of a double salt.

Potassium cuprothiosulphate crystallises in beautiful, yellow prisms, having the composition $Cu_2S_2O_3,2K_2S_2O_3 + 2H_2O$; recrystallisation from water yields a tetrahydrate differing in crystalline form from the dihydrate. The cuprous salt described by Cohen (*loc. cit.*) is probably a mixture of these hydrates. The solution is intensely yellow, and gives the reactions of a cuprous salt. M. O. F.

Cuprosammoninm Bromides and Cuprammonium Thiocyanates. By Theodore W. Richards and Benjamin S. Merigold (*Zeit. anorg. Chem.*, 1898, 17, 245—252).—*Cuprosammonium bromide*, $Cu_2Br_2(NH_3)_2$, is obtained by dissolving cuprous bromide (10 grams) in the least possible quantity of ammonia, and adding acetic acid (25 c.c), the crystalline product being washed with alcohol and ether, and dried over sulphuric acid under diminished pressure; all the operations must be carried out in an atmosphere of hydrogen. It crystallises in long, flat, colourless prisms, is quite stable when dry, but quickly oxidises when exposed to the air in contact with water, and is easily soluble in ammonia and nitric acid.

Cuprosammonio-thiocyanate, $Cu_2(NH_3)_2(SCN)_2$, obtained by adding ammonium thiocyanate to a solution of cuprous hydroxide in ammonia, is a white, crystalline powder which quickly loses ammonia on exposure to the air.

Tetrammonio-cuprosammonium bromide, $Cu_2Br_2(NH_3)_6$(?), is obtained by saturating finely powdered cuprous bromide, cooled with ice, with dry ammonia; it is a black powder, decomposed by water, and soluble in ammonia and nitric acid. It is extremely unstable, and easily gives off its ammonia.

Triammonio-cuprosammonium thiocyanate, $Cu_2(NH_3)_5(SCN)_2$, obtained by saturating powdered cuprous thiocyanate with dry ammonia, is a black powder which is very unstable, and quickly gives off ammonia on exposure to the air.

Diammonio-cuprammonium thiocyanate, $Cu(SCN)_2(NH_3)_4$, is obtained by adding ammonium thiocyanate to a solution of cuprammonium bromide, and then adding sufficient ammonia to dissolve the precipitate which is produced; the new compound soon separates from this solution in lustrous, deep-blue crystals. It gives off ammonia on exposure to the air, is decomposed by water and dilute acids, and is soluble in hot concentrated hydrochloric acid, in cold concentrated nitric acid, and in ammonia. E. C. R.

Colloidal Silver. II. By Alfred Lottermoser and Ernst von Meyer (*J. pr. Chem.*, 1898, [ii], 57, 540—543. Compare this vol., ii, 116).—In order to study the influence of time on the change of colloidal to molecular silver, a certain amount of acid was added in one portion to a solution of colloidal silver, and the time necessary for the complete change observed; the end of the reaction is easily determined by placing a drop of the solution on a glass plate, and looking through this on to white paper; as soon as the separation of fine silver particles could be clearly seen, the time was noted.

The results of experiments which are tabulated show that the less the amount of acid used, the longer the time necessary for the reaction; and the amount of acid which will produce the change in a certain time stands in inverse proportion to the concentration of the solution.

In continuation of their work on the precipitation of colloidal silver by salts of the heavy metals, the authors show that in the case of reducible metallic chlorides, silver chloride and the lower chloride of the metal are formed; a part of the silver is, however, always precipitated in the insoluble form. If both solutions (colloidal silver and metallic chloride) are very dilute, it often happens that neither silver chloride nor the lower chloride of the metal are precipitated but remain in solution in the colloidal form; particularly is this the case with mercuric chloride.

Colloidal silver iodide appears to be of therapeutic interest, but, like colloidal silver chloride and bromide, has no use in photography.

A. W. C.

Ammonio-Silver Bromides. By R. Jarry (*Compt. rend.*, 1898, **126**, 1138—1142).—Dry silver bromide is converted by liquefied ammonia into a white powder, which at 4° loses a large quantity of ammonia, and at about +35° loses a second quantity of the gas, a residue of yellow silver bromide being left. The compound stable below 4° has the composition $AgBr,3NH_3$, whilst that stable up to 35° has the composition $2AgBr,3NH_3$, the two being analogous respectively to the ammonio-silver chlorides (Abstr., 1897, ii, 259). Their dissociation pressures are as follows.

$AgBr,3NH_3$.

t°	−23°	−18°	−8°	0°	3·5°	8·0°	14°	20°	23°
p	14	19·5	36	60·5	74·5	92	131	182	214 mm.

$2AgBr,3NH_3$.

t°	0°	4°	10·4°	11·2°	14°	16·6°	28·6°	43·8°	53°
p	8·8	10·7	16·6	17·4	20·6	24·9	51·3	122·5	198·6 mm.

The absorption of gaseous ammonia by silver bromide, even at −20°, is very slow, and this probably explains Rammelsberg's statement that no absorption takes place. Liquefied ammonia dissolves a small quantity of the compound $AgBr,3NH_3$, and deposits it in transparent, birefractive needles when allowed to evaporate. The compound $2AgBr,3NH_3$ is likewise obtained in small needles by allowing a solution of silver bromide in ordinary ammonia to evaporate over potash or lime in an atmosphere of ammonia. Highly concentrated ammonia solution, in contact with silver bromide, seems to convert it into the compound $AgBr,3NH_3$, which, however, is decomposed on dilution, whilst the second compound is decomposed on further dilution.

The solubility of silver bromide at 0°, in 10 c.c. of ammonia solution of various strengths, is as follows.

NH_3. Gr.	AgBr. Mgr.	NH_3. Gr.	AgBr. Mgr.	NH_3. Gr.	AgBr. Mgr.	NH_3. Gr.	AgBr. Mgr.
0·307	8·0	1·151	34·9	2·627	106·7	3·722	288·8
0·488	9·6	1·532	55·7	3·126	156·8	3·770	293·0
0·669	17·2	1·809	72·2	3·389	198·7	3·926	289·2
0·829	21·2	1·953	74·1	3·652	266·9	3·995	285·0

The curve representing these results shows two breaks corresponding with solutions saturated under the dissociation pressures of the two compounds $AgBr,3NH_3$ and $2AgBr,3NH_2$ respectively, the three sections of the curve, therefore, representing, first, the solubility of silver bromide; secondly, the solubility of the compound $2AgBr,3NH_3$, and lastly, the solubility of the compound $AgBr,3NH_3$. The two compounds form and dissociate in ammonia solution, just as they do in a vacuum. C. H. B.

Silver Peroxynitrate and Silver Peroxide. By EDUARD MULDER (*Rec. Trav. Chim.*, 1898, 17, 129—176. Compare Abstr., 1896, ii, 561; 1897, ii, 260 and 551).—When the compound Ag_7NO_{11} is deprived of an atom of oxygen and the product extracted with water, silver nitrate passes into solution, and silver peroxide, Ag_2O_2, is left. The silver nitrate can be extracted in a short time, and it is suggested that the compound Ag_7NO_{11} has the composition $3Ag_2O_2,AgNO_3$. When the peroxynitrate is boiled with water, oxygen is liberated, silver nitrate goes into solution, and a residue of silver peroxide is obtained. This is the most convenient method for the preparation of the peroxide on a fairly large scale.

The peroxide dissolves in either concentrated nitric or sulphuric acid, yielding brown solutions; decomposition is facilitated by the presence of water. Acetic acid itself does not dissolve the peroxide, but in presence of water, silver acetate, water, and oxygen are obtained. The author gives a list of silver peroxides which have been described by different authorities.

A method for estimating the oxygen excess in the peroxynitrate is described; it is based on the decomposition of the compound with water. The peroxynitrate undergoes slow, spontaneous decomposition when kept for any length of time, even over sulphuric acid, the decomposition is so slow, however, that it would require about 13 years for the two atoms of oxygen (oxygen excess) to be eliminated. J. J. S.

Amalgams. By WILHELM KERP (*Zeit. anorg. Chem.*, 1898, 17, 284—309).—Sodium amalgam containing 2·5—3 per cent. of sodium was prepared by melting sodium with mercury. When this solid amalgam is dissolved in warm mercury and the solution allowed to cool, a crystalline amalgam separates when the solution contains 0·7 per cent. or more of sodium; the author has determined the composition of the crystals and the mother liquor obtained by dissolving known weights of the solid amalgam in mercury at known temperatures. The mixture of amalgam and mercury is placed in a sealed tube and shaken in a thermostat, and when the solution is complete, the crystals are separated by filtration with the aid of an air pump through a leather dish arranged in a Gooch's crucible. The sodium in the amalgam is estimated by treating a weighed portion with an excess of N/2 hydrochloric acid and determining the excess of acid with barium hydroxide solution, using "ethyl-orange" as indicator.

At temperatures from 0° to 100°, the crystalline amalgam has the composition $NaHg_5$, and all the mother liquors separated at 25° and above deposited the same compound on cooling; the percentage of sodium in the mother liquors varies from 0·544 at 0° to 1·10 at 99·8°. The solubility of sodium in mercury is, therefore, very small, and is comparable with that of potassium, barium, and strontium; thus 100 parts of amalgam at 0° contain 0·25 parts K, 0·544Na, 0·17 Ba, and at the ordinary temperature 0·45K, 0·643Na, 0·33Ba, and 0·90—1·00 parts Sr. It is remarkable that sodium is more soluble than potassium, and strontium than barium. Sodium amalgam has no definite melting point, it begins to soften at 105°, is converted into a fluid magma at 119°, and is completely molten at 138—139°; on allowing the mass to cool, crystals begin to form at 137°, at 128° it is full of beautiful needles, and is completely solid at 103°. This behaviour indicates the formation of a more concentrated amalgam above 100°, and shows that the solubility of sodium increases rapidly above 100°, since the amalgam which melts at 138° must contain at least 2·25 per cent. of sodium.

Potassium amalgam was obtained by the electrolysis of a solution of potassium chloride, using a mercury cathode. The apparatus, which is fully described in the paper, is so arranged that the mercury can be passed through the potassium chloride several times, and the mixture of solid and liquid amalgam is collected in an atmosphere of hydrogen. The crystals are separated from the mother liquor by filtration in the same way as described above for sodium amalgam. The larger crystals must be completely broken up, as they are very porous and absorb large quantities of the mother liquor. The amalgam crystallises in large, silvery cubes truncated by octahedral and dodecahedral faces, and has the composition KHg_{12}.

Barium amalgam, which can be very easily obtained in a similar manner to potassium amalgam, by the electrolysis of a saturated solution of barium chloride, crystallises in small, hard, lustrous cubes, and has the composition $BaHg_{12}$ when prepared between 21° and 81°. The mother liquor contains, at 0°, 0·160 to 0·178 per cent. of barium, and at 81°, 0·969 per cent. The amalgam is very easily oxidised on exposure to the air, and cannot, therefore, be fused in the air; it is, however, very slowly attacked by water, and oxidised samples can be purified by washing with water.

Strontium amalgam, obtained by the electrolysis of a saturated solution of strontium chloride, is somewhat difficult to prepare on account of the ease with which it is attacked by water; during the electrolysis large quantities of hydrogen are evolved, and the solution of strontium chloride quickly becomes saturated with strontium chlorate. The amalgam separates in very slender crystals, and is quickly oxidised on exposure to the air. When crystallised at the ordinary temperature, it has the composition $SrHg_{11}$, when crystallised at 64—81°, the composition $SrHg_8$.

Sodium amalgam containing 0·685 per cent. sodium is very slowly decomposed by water or N/10 solutions of sodium chloride, carbonate, or pure hydroxide; with the ordinary pure sodium hydroxide of commerce, however, the decomposition is very rapid, being for N/4 solutions 40 times as great as with water, and for N/10 solutions 5 times as great. This increase in the rapidity of the decomposition is due to traces of silica, iron, zinc, and aluminium, and when a small quantity of the hydroxide of a metal which is soluble in sodium hydroxide is added to a solution of pure sodium hydroxide, the rate of decomposition of the amalgam is greatly increased. E. C. R.

New Method of Fractionating Metals of the Yttrium Group. By G. URBAIN (*Compt. rend.*, 1898, **126**, 835—838).—The ethyl sulphates of the metals of the yttrium group, which are easily prepared by the interaction of barium ethyl sulphate and the sulphate of the particular metal, crystallise very readily. These facts can be utilised for the separation, by fractional crystallisation, of the various metals, which crystallise in the following order: yttrium, terbium, holmium, and dysprosium, erbium, ytterbium. C. H. B.

Separation of the Cerite Metals: Solubility of their Sulphates in Water. By WILHELM MUTHMANN and H. RÖLIG (*Ber.*, 1898, **31**, 1718—1731. Compare this vol., ii, 376).—The authors describe a series of experiments undertaken with the object of devising a method of separating the cerite metals. They have obtained the enneahydrate of lanthanum sulphate, the octo- and penta-hydrates of praseodymium sulphates, and the octohydrate of neodymium sulphate; the solubilities of these salts in water have been determined, and the appropriate curves are given in the original paper.

M. O. F.

Neodymium. By O. BOUDOUARD (*Compt. rend.*, 1898, **126**, 900—901).—Neodymium can be isolated by allowing a solution of the pure sulphates of the yttrium metals to remain in contact with excess of potassium sulphate for at least 24 hours, decomposing the insoluble double sulphate with sodium hydroxide, dissolving the oxide thus obtained in nitric acid, and precipitating with oxalic acid. The metal thus isolated has the atomic weight 143, which agrees closely with the value 142·7 obtained in previous experiments. The oxide is greenish, the oxalate and anhydrous sulphate are slightly rose-coloured; the crystallised sulphate, which is rose-coloured, is less soluble than the anhydrous sulphate, and is more soluble in cold water than in hot.

The absorption spectrum of the sulphate of this metal is as follows: 591·5 to 584, shadow; 584—572, intense band; 523—519, intense band; 512—508, feeble band; 480 and 470, faint bands, probably due to traces of praseodymium.

It is noteworthy that neodymium forms a double sulphate with potassium more soluble than the praseodymium compound.

C. H. B.

Spectrum and Elementary Nature of Neodymium. By EUGÈNE DEMARÇAY (*Compt. rend.*, 1898, **126**, 1039—1041).—Didymium oxide, carefully purified from lanthanum and cerium, and fractionated by Auer von Welsbach's method of ammoniacal nitrates, yielded neodymium free from samarium and praseodymium. Repeated fractionation by the method indicated, and also by other methods, failed to produce any alteration in the spectrum, and it follows that neodymium is an elementary body and not a mixture of two or more substances as has been asserted.

Neodymium oxide prepared from the oxalate has, contrary to the statements of other observers, a pale bright blue colour, which is distinctly altered by very small quantities of praseodymium, samarium, or terbium. The colour of its salts varies, according to the concentration of the solution, from lilac blue to reddish-violet, but in presence of small quantities of samarium or praseodymium compounds the colour is a yellowish- or brownish-red.

An acid solution of the chloride shows the following bands: 7324, 6910, 6804 (strong), 6731 (feeble), 6373, 6292 (double and very feeble), 6234, 5783 (about the middle of the very strong band), 5220 (about the middle of the strong band), 5320 (fairly strong), 5109 (very strong in the middle), 4768 (strong), 4691 (strong), 4624 (nebulous and diffuse, but fairly strong), 4351 (feeble), 4294 (very feeble), 4281 (strong), 4200 (very feeble).

The bands below 5109 are rendered very faint and indistinct by the presence of a certain quantity of samarium, and this may explain why they have not been observed by other investigators. Some of the bands are greatly affected by variations in the nature of the acid; the small group about 6300, for example, is very difficult to recognise in presence of nitric acid. C. H. B.

Praseodymium. By Carl von Schele (*Zeit. anorg. Chem.*, 1898, **17**, 310—326).—The praseodymium compounds are obtained as follows. Monazite sand is decomposed by sulphuric acid, the aqueous solution precipitated with oxalic acid, and the washed precipitate dried at 100° and dissolved in concentrated nitric acid. The cerium and thorium salts are separated by repeatedly evaporating the solution, and the solution containing the other oxides is mixed with ammonium nitrate and subjected to fractional crystallisation according to Welsbach's method. The praseodymium salts collect in the fractions between the lanthanum and didymium fractions. The fractions richest in praseodymium are then mixed with sodium nitrate and fractionally crystallised; of these, the fractions which contain neodymium are converted into the double salt with ammonium nitrate mixed with cerium ammonium nitrate, and fractionally crystallised, when the praseodymium accompanies the cerium salt and the neodymium remains in the mother liquors. The product thus obtained is free from neodymium, and contains only a trace of lanthanum. It is boiled with ammonium nitrate, which dissolves any sesquioxides, and the peroxide is finally converted into the oxalate and fractionally crystallised from nitric acid. The author, on subjecting the product to fractional crystallisation from ammonium nitrate and examining the different fractions spectroscopically, was unable to detect the presence of any other element in the praseodymium except a trace of lanthanum.

Praseodymium yields two oxides, namely, Pr_2O_3 which is green, and PrO_2, which is black; only the first of these is capable of forming salts. The atomic weight was determined as follows: the oxalate was converted into the peroxide by heating at a red heat, the peroxide reduced to oxide by heating in a platinum boat in a current of hydrogen at a white heat, and then the weight of the sulphate obtained from a known weight of oxide was determined. The mean of five determinations gave 140·40 ($O = 16$, $S = 32$).

Praseodymium peroxide, PrO_2 is a black, lustrous powder obtained by heating praseodymium salts in the air or in a current of oxygen. When strongly heated, it gives off oxygen, and is converted into the green oxide; it yields chlorine when treated with hydrochloric acid, and oxygen when treated with other acids. When treated with ferrous ammonium sulphate, or with an acid solution of stannous chloride, part of the oxygen escapes without oxidising the ferrous or stannous salt. The analysis of the oxide can, however, be effected by heating it at a high temperature in a current of hydrogen.

Praseodymium oxide, Pr_2O_3, obtained by reducing the peroxide, is very similar to lanthanum oxide. It absorbs carbonic acid from the atmosphere, and is converted into the peroxide when heated in the air or when fused with potassium chlorate. The sp. gr. = 6·881.

E. C. R.

Synthesis of Crystalline Alumina by the Action of Chlorine on an Alkali Aluminate. By H. Loyer (*Bull. Soc. Chim.*, 1897, [iii], **17**, 345—346).—When a slow current of chlorine is passed through a heated porcelain tube containing potassium or sodium aluminate mixed with 1 per cent. of potassium chromate, oxygen is evolved, and a rose-coloured, crystalline mass is formed. This consists, for the most part, of well-defined hexagonal crystals, like those of the ruby, which are insoluble in hydrochloric and nitric acids, and sink in methylenic iodide. N. L.

Water of Crystallisation of Manganous Sulphate. By W. Schieber (*Monatsh.*, 1898, **19**, 280—297).—Manganous sulphate separates from an aqueous solution below 0° as the heptahydrate, between 15° and 20° as the pentahydrate, between 25° and 31° as the rhombic tetrahydrate, and between 35° and 40° as a mixture of the rhombic and monoclinic tetrahydrates; all these hydrates, on warming to 55° or on standing for some days over sulphuric acid, become converted into the monhydrate.

The hexa-, tri-, and di-hydrates do not exist. G. T. M.

Tetrahydrated Oxide of Iron. By Walthère Spring (*Rec. Trav. Chim.*, 1898, **17**, 222—223).—If the voluminous precipitate obtained by the addition of ammonia to a dilute solution of ferric chloride or sulphate is dried spontaneously at the ordinary temperature, a vitreous substance is obtained, which is black in mass but red by transmitted light. It has the composition $Fe_2O_3,4H_2O$. Placed in a desiccator, it loses water; its sp. gr. = 2·436 at 15°, and it is not decomposed by pressure. J. J. S.

A New Chromium Silicide. By Ch. Zettel (*Compt. rend.*, 1898, **126**, 833—835).—When a mixture of 140 parts of copper and 140 parts of aluminium is melted in a fire-clay crucible and 200 parts of chromic oxide, previously strongly heated, is added gradually, and after strongly heating for some time, a small quantity of aluminium filings, there is a very energetic action. The metallic ingot obtained on cooling contains crystals of a chromium silicide, $SiCr_3$, which is separated from the metal by the action of aqua regia. It is not attacked by any acids with the exception of hydrofluoric acid, but chlorine and bromine decompose it at a red heat. Sulphur has no action at dull redness, and fused potassium chlorate attacks the silicide with difficulty even at a red heat. Fused potassium hydroxide attacks it slowly, but a fused mixture of alkali nitrates and carbonates decomposes it rapidly. The crystals scratch glass but not quartz; sp. gr. = 6·52 at 18°. C. H. B.

Tungsten Iodide. By Ed. Defacqz (*Compt. rend.*, 1898, **126**, 962—974).—When hydrogen iodide acts on sublimed tungsten hexachloride at about 400°, tungsten di-iodide, WI_2, is obtained as an amorphous, brown powder of sp. gr. 6·9 at 18°, and insoluble in water, alcohol, or carbon bisulphide. It is infusible and non-volatile; when heated in air, it is oxidised, and when heated above 500° in hydrogen it is reduced. Chlorine decomposes it at about 250°, and bromine at about 350°. Hydrogen iodide reduces it at 500—600°, and it is also attacked by carbonic anhydride at this temperature. Sulphur and phosphorus convert the iodide into sulphide and phosphide respectively, and boiling water gradually converts it into the blue oxide. Hydrochloric and hydrofluoric acids attack the iodide very slowly, but boiling nitric or sulphuric acid, or aqua regia, converts it into tungstic anhydride. Aqueous potash or fused potassium hydroxide, alkali carbonates, or mixtures of alkali carbonates and nitrates readily oxidise the iodide. C. H. B.

Alums of Titanium Sesquioxide. By Augusto Piccini (*Zeit. anorg. Chim.*, 1898, **17**, 355—362).—*Cæsium titanium alum*,

$$Ti_2(SO_4)_3,Cs_2SO_4 + 24H_2O,$$

is obtained by dissolving precipitated titanic acid in a slight excess of dilute sulphuric acid, adding the theoretical quantity of a cold solution of cæsium sulphate, and then subjecting the mixture to electrolysis, using as a diaphragm an ordinary porous cylinder; the solution at the negative pole quickly becomes violet and deposits crystals of the alum. It is purified in an atmosphere of carbonic anhydride by recrystallisation from water acidified with sulphuric acid, when it forms pentagonal, hemihedral, bright violet crystals belonging to the cubic system; it is very sparingly soluble in cold water, more so in hot water, and the solution quickly becomes turbid on exposure to the air, with precipitation of titanic acid. When heated in the air, it is oxidised, giving off vapours of water and sulphuric acid.

Rubidium titanium alum, $Ti_2(SO_4)_3,Rb_2SO_4 + 24H_2O$, prepared in a similar manner to the cæsium salt, crystallises in transparent, bright red crystals belonging to the cubic system; it is very similar to the cæsium salt, but is more soluble in water.

The author was unable to obtain the potassium or ammonium alum in a crystalline condition. He points out that cæsium sulphate is the best salt to employ for determining whether a sesquioxide is capable of forming alums, and mentions that cæsium manganese alum, $Me_2(SO_4)_3,Cs_2SO_4 + 24H_2O$, is easily obtained by the method described above. E. C. R.

Alkali Thioantimonites. By Pouget (*Compt. rend.*, 1898, **126**, 1144—1145).—Sodium thioantimonite, Na_3SbS_3, is obtained on dissolving antimony sulphide in sodium sulphide solution and evaporating in an atmosphere of hydrogen. It forms colourless needles which act strongly on polarised light, and have the composition $Na_3SbS_3 +$

$9H_2O$; they become anhydrous when heated above 150° in a current of hydrogen. The compound oxidises very readily in solution and yields the thioantimonate and a black compound, $2Sb_2S_3,3Na_2S$.

Sodium pyrothioantimonite could not be obtained by the same method as the potassium salt, owing to the difficulty of preventing oxidation. If the solutions are concentrated by heat they yield thioantimonite and the insoluble black metathioantimonite, $NaSbS_2$; when dilute solutions are evaporated in a vacuum, they yield small red crystals of the compound $Na_2Sb_4S_7 + 2H_2O$, analogous to the potassium salt described by Ditte.

When precipitated antimony sulphide is mixed with a cold concentrated solution of ammonium sulphide, it is partly converted into the normal thioantimonite, which dissolves and can be precipitated as a white, crystalline powder by adding alcohol, and partly into crystals of the insoluble metathioantimonite, NH_4SbS_2. In presence of air, or when heated, these crystals are converted into small red crystals of the compound $(NH_4)_2Sb_4S_7$, which is comparatively stable, and is the only product when the antimony sulphide is dissolved in a hot or a somewhat dilute solution of ammonium sulphide. C. H. B.

Aqueous Solutions of Metallic Gold. By **Richard Zsigmondy** (*Annalen*, 1898, **301**, 29—54).—A red solution of metallic gold in water may be prepared by treating a feebly alkaline, boiling solution of gold chloride with a reducing agent; formaldehyde is the most suitable, less satisfactory results being obtained with acetaldehyde, alcohol, or hydroxylamine. The solution is not always red and clear; it is often dark-purple, violet, or bluish-black, and appears turbid, especially if the formaldehyde is not mixed rapidly with the gold solution. The presence of minute quantities of phosphates of the alkaline earths is sufficient to prevent the formation of these red solutions.

The metallic solutions prepared according to directions given in the paper are very dilute, 100 c.c. containing about 0·005 gram of gold; when boiled, they undergo no change until somewhat less than half the original volume in bulk, when they become violet-black, and deposit gold as a black powder. Dialysis affords the most satisfactory means of concentrating the solutions, which become of an intense red, and finally contain 0·12 per cent. of colloidal gold. Such solutions are tasteless. They become blue when treated with solutions of neutral salts, which slowly precipitate finely divided gold, leaving the liquid colourless; potassium ferrocyanide, however, develops a green coloration, which subsequently becomes yellow, without precipitation of the metal. Mineral acids produce the same effect as neutral salts, but acetic acid changes the red colour of the solution to violet-red, and finally black, gold being precipitated slowly; alkalis precipitate blue gold, whilst ammonia is without influence. Excess of alcohol gradually changes the colour of gold solutions to dark violet, completely precipitating the metal, which retains the property of dissolving in water (compare Schneider, Abstr., 1892, 775). Aqueous solutions of metallic gold behave like most other dissolved colloids when submitted to the action of a current of electricity; the metal travels with negative electricity, but fails to penetrate the membrane. Mercury is without action on gold dissolved in water. Solutions which have not been purified and concentrated by dialysis develop, during one or two weeks, small cultures of mould; these decolorise the solutions without precipitating the metal, which appears to be absorbed in the mycelium.

The absorption spectra of the gold solutions have been compared with those of gold glass and thin sheets of the metal. M. O. F.

NOTE.—In the collection of chemical specimens at Guy's Hospital is a solution of colloidal gold, prepared more than 30 years ago. There has been no perceptible change in the deep red colour during the last 15 years, although the specimen has been constantly exposed to diffused daylight.—EDITOR.

Mineralogical Chemistry.

Roumanite. By CONSTANTIN I. ISTRATI (*Bull. Soc. Sci. Bucarest*, 1898, 7, 272—273. Compare Abstr., 1897, ii, 502).—Roumanite is noted from two new localities in Roumania, namely, in the districts of Prahova and Bouzéou. The new material is clear yellow and perfectly transparent; it has a spangled appearance, like avanturine, due to numerous minute fractures. Sp. gr. 1·0536 at 25°. Refractive index for sodium light, 1·53774. At 325°, it blackens without fusing. Analysis gave

C.	H.	S.	Ash.
79·98	10·47	0·918	0·130
79·80	10·78	0·876	0·096

This is purer than the darker varieties, and contains less carbon and ash. L. J. S.

Natural Gas in East Sussex. By CHARLES DAWSON (*Quart. Journ. Geol. Soc.*, 1898, 54, 564—571. Compare following abstract).—From a boring made for water at Heathfield railway station, in August, 1896, there is a large escape of gas under considerable pressure. The boring reaches to the Purbeck series, and passes through bands of bituminous shale and lignite. Analysis of the gas by S. A. Woodhead gave

O.	CO.	CH_4.	Higher hydrocarbons.	Total.
18·0	4·0	72·5	5·5	100·0

L. J. S.

Natural Gas at Heathfield Station, Sussex. By JOHN THEODORE HEWITT (*Quart. Journ. Geol. Soc.*, 1898, 54, 572—573).—Analysis of the gas from the Heathfield boring gave the following results, which are quite different from those mentioned in the preceding abstract.

CH_4.	H.	N.	Total.
91·9	7·2	0·9	100·0

Oxygen, carbonic anhydride, carbonic oxide, olefines, and hydrocarbon vapours were absent in the sample analysed.

Carbonaceous shale from a depth of 300 feet in the boring contained

C.	H.	N.	S.	O.	Ash.	Total.
9·43	1·83	0·68	1·27	[4·97]	81·82	100·00

The ash of this gave on analysis

SiO_2.	Al_2O_3.	Fe_2O_3.	CaO.	MgO.	SO_3.	P_2O_5.	Alkalis and loss.	Total.
59·72	24·40	7·03	2·14	0·96	2·54	Nil	[3·21]	100·00

L. J. S.

Artificial Production of Periclase by a New Method. By August B. de Schulten (*Bull. Soc. fran. Min.*, 1898, **21**, 87—88).—By heating potassium hydroxide and magnesium hydroxide at 200°, brucite (MgO,H_2O) was obtained (Abstr., 1885, 1183), whilst at a red heat periclase (MgO) is formed in limpid, regular octahedra. Potassium hydroxide (200 grams) and magnesia (8—9 grams) are fused at a red heat, the mixture allowed to cool slowly, and the crystals washed with chlorine water and nitric acid. Analysis showed the presence of 99·92 per cent. MgO, and traces of iron. Sp. gr. 3·566. L. J. S.

Constitution and Formation of Bauxite. By G. L. Bourgerel (*Chem. Centr.*, 1898, 1, 406; from *Mont. Scient.*, 1897, [iv], **12**, 21—22).—The bauxites of the South of France (Dept. Var) are of various colours, the red (I) and the white (II) being well-marked varieties. The red is used for the manufacture of aluminium, and the white for the preparation of aluminium sulphate; intermediate varieties are mixed with plastic clay for the manufacture of refractory bricks.

	Al_2O_3.	Fe_2O_3.	SiO_2.	TiO_2.	V, Cr, &c.	H_2O.
I (red)....	62—50	24—28	1—7	0·10—4	traces	12—13
II (white).	74—65	0·25—3	12—18	varies	—	14

The bed of bauxites has a thickness of 50 m., and occurs in sedimentary limestones. To account for the formation of bauxite, the author assumes interaction between quicklime and hot, concentrated solutions of aluminium and iron chlorides. L. J. S.

Composition of Spar from Knaresborough. By B. Arthur Burrell (*Proc. Yorks. Geol. and Polyt. Soc.*, 1898, **13**, 284—285).—Celestite ($SrSO_4$) has long been known at Knaresborough, and strontium has been detected in the waters (Trans., 1896, 536); the rocks of the neighbourhood would therefore be expected to contain small quantities of strontium. With a view to testing this, the following analysis was made of brown crystalline spar from Mother Shipton's Cave,

SiO_2.	P_2O_5.	SO_3.	CO_2.	CaO.	MgO.	SrO.	Mn_3O_4.	Fe_2O_3	Alkalis.
0·037	0·005	2·331	42·170	55·038	0·190	0·128	0·019	0·006	trace

This corresponds with $CaCO_3$, 95·494; $CaSO_4$, 3·793; $SrSO_4$, 0·227 per cent. L. J. S.

Compact Muscovite from Montrambert (Loire). By Georges Friedel (*Bull. Soc. fran. Min.*, 1898, **21**, 135—137).—The schists met with in the coal mine of Montrambert contain, in contact with the knots of quartz, a compact, apparently amorphous mineral, yellowish-green in colour; small fragments are colourless and transparent; sp. gr. 2·783. Microscopical examination of thin sections shows that it consists of a confused, or sometimes plumose, aggregate of lamellæ and fibres having the optical characters of muscovite. Analysis gave

SiO_2.	Al_2O_3.	Fe_2O_3.	CaO.	MgO.	Na_2O.	K_2O.	H_2O.	Total.
45·77	37·70	1·98	0·95	0·89	0·75	7·66	4·51	100·21

This agrees with the muscovite formula $RO,Al_2O_3,2SiO_2$ where $R = \frac{2}{3}H_2 + \frac{1}{3}(K_2, Ca, \&c.)$. The mineral differs from alteration products of the pinite group in its transparency and mode of occurrence; and it is to be regarded as a peculiar variety of sericite. L. J. S.

Jadeitite from Piedmont. By L. Mrazec (*Bull. Soc. Sci. Bucarest*, 1898, 7, 187—196).—The rock described is a rolled pebble of a fine dark green colour with white spots, and resembles jade in appearance, toughness, and fracture. Sp. gr. 3·346. Analysis of the green portion gave

SiO_2.	TiO_2.	Al_2O_3.	Fe_2O_3.	MnO.	CaO.	MgO.	Na_2O.	K_2O.	Loss on ignition.	Total.
56·92	trace	18·74	5·73	trace	4·31	2·64	12·11	trace	0·25	100·70
56·64	trace	18·33	6·41	trace	4·83	2·46	—	trace	—	—

This green portion has the optical characters of pyroxene, and it is therefore jadeite; the white spots are felspar, probably oligoclase. For this rock (jadeite-pyroxenite of Berwerth), the name jadeitite is proposed; it has a slightly schistose structure, and is supposed to be of dynamometamorphic origin (compare Abstr., 1896, ii, 310—311; 1897, ii, 508). L. J. S.

Ferruginous Colouring Matters of Sedimentary Deposits and the Probable Origin of Red Rocks. By Walthère Spring (*Rec. Trav. Chim.*, 1898, 17, 202—221).—Ferruginous rocks can be divided into four groups, green, ochre-yellow, wine-red, and black. The author attempts to explain the presence of two or more of these in the same strata, for example, in the Devonian series. It is shown that the yellowish-brown rocks do not owe their colour merely to ferric hydroxide as previously supposed, but to a compound of ferric hydroxide with a colourless oxide such as silica, magnesia, lime, or alumina, and as these compounds are much more stable than ferric hydroxide, they retain their colour when dehydrated, only turning brick-red on calcination, and at the same time becoming magnetic; they also resist the action of saline waters better than the simple hydroxide. The green rocks do not owe their colour to a simple ferrous silicate, but to a ferroso-ferric silicate, they are thus a special group of the black rocks coloured by magnetite.

Ferric hydroxide, when in a compact form, retains its water only in an atmosphere the humidity of which is equal to its dissociation tension and at not too high a temperature; in a light form, under water, it crystallises and becomes dehydrated. J. J. S.

Meteoric Irons. By Emil W. Cohen (*Ann. k.k. naturhist. Hofmus. Wien*, 1898, 13, 45—58).—*Smithland*, Livingston Co., Kentucky. Analysis I corresponds with the mineralogical composition: nickel-iron, 99·00; schreibersite and rhabdite, 0·58; troilite, 0·27; daubréelite, 0·15 = 100·00; sp. gr. 7·7115.

Botetourt, Virginia. This is an ataxite rich in nickel; analysis II (on 17 mg.). The sp. gr., 8·186, is higher than that of any other meteorite. Specimens in the Göttingen collection are shown to be artificial.

Scriba, Oswego Co., New York. The structure is that of artificial iron, and the composition (analysis III) is not against this, since small quantities of cobalt, up to half a per cent., have been found in artificial irons.

Hemalga, Tarapaca Desert, Chili. The cavities contain metallic lead and a black slag composed of iron, silica, and calcium. The deficiency in analyses IV and V represents oxygen in the slag and in lead oxide and carbonate. Although the structure resembles that of an ataxite, the physical characters and composition prove this iron to be a pseudometeorite.

Nauheim, Wetterau, Grand Duchy of Hesse. In structure and composition this is an artificial iron; besides 79·97 per cent. of metallic iron, it contains 18·10 per cent. of $2Fe_2O_3,3H_2O$.

St. Augustine's Bay, Madagascar. This is also shown to be an artificial iron containing no nickel.

Analyses I—V (and others) by O. Sjöström.

	Fe.	Ni.	Co.	P.	S.	Cr.	C.	Pb.	SiO_2.	Residue.	Total.
I.	82·83	16·42	0·94	0·09	0·17	0·06	—	—	—	—	100·51
II.	85·88	18·23		trace	—	—	—	—	—	—	104·11
III.	99·79	nil	0·27	0·09	—	—	0·06	—	—	—	100·21
IV.	81·89	nil	nil	not det.	—	—	—	9·12	1·26	1·17	93·44
V.	77·51	nil	nil	0·02	—	—	—	11·64	2·05	2·60	93·82

It has recently been stated that, while pyrrhotite is a conductor of electricity, troilite is a non-conductor. New experiments, however, show that troilite taken from several meteoric irons is a good conductor.

L. J. S.

Meteoric Iron from Cincinnati, U.S.A. By Emil W. Cohen (*Sitz.-Ber. Akad. Berlin*, 1898, 428—429).—All that is known of the history of this iron is that it was presented to the Munich collection by Hosaeus. The etched surface is lumpy and pitted, but varies in character in different portions, and is in parts granular; it is suggested that this structure may be due to the presence of fine lamellæ of troilite. A little schreibersite is present. Analysis by O. Sjöström gave

Fe.	Ni.	Co.	Cu.	P.	S.	Cr.	Total.	Sp. gr.
94·47	5·43	0·68	0·01	0·05	0·05	nil	100·69	7·6895

This corresponds with 99·54 per cent. of nickel-iron. The structure resembles, but does not completely agree with, that of the Campo del Cielo and Siratik irons; and the three may be grouped together as ataxites poor in nickel.

L. J. S.

Chalybeate Waters in Silesia. By Ernst Ludwig and V. Ludwig (*Chem. Centr.*, 1898, **1**, 1036; from *Wien. klin. Wock.*, 1898, **11**, 207—210).—Analyses are given of waters from the "Marien" and "Paula" springs at Johannisbrunn. L. J. S.

Gases from the Abano Springs and the Boracic Soffioni of Tuscany and the Combustible Gas from the Bolognian Appenines. By Raffaele Nasini, Francesco Anderlini, and Roberto Salvadori (*Gazzetta*, 1898, **28**, i, 81—153).—The authors have examined and analysed the gas escaping with hot mineral water at Monte Irone in Abano, the gas from the Casotto soffione and the Tini soffione at Larderello in Tuscany, and the combustible gas from the mineral water of the Porretta baths. The gas from the first source contains 72 per cent. of nitrogen, 1·2 of methane, 15 of carbonic anhydride, and a little hydrogen sulphide; that from the second and third consists principally of carbonic anhydride with a little hydrogen sulphide, whilst the Porretta gas contains about 90 per cent. of methane. The unabsorbed residues containing the nitrogen were in each case examined; that from the Abano gas contains 2 per cent. of argon with a little helium, whilst that from Larderello gas contains 2 per cent. of argon and 1 per cent. of helium, thus affording a good source of helium, which the authors propose to utilise. The residual gas from the Bolognian Appenines contains no helium and 2 per cent. of argon.

The results obtained from the spectroscopic examination, and drawings of the apparatus used, are given. W. J. P.

Physiological Chemistry.

Experiments with Sheep on the Digestibility of several kinds of Dried Distillery-residues. By Oscar Kellner, A. Köhler, F. Barnstein, and L. Hartung (*Landw. Versuchs-Stat.*, 1898, **50**, 297—316).—The residues investigated were derived from (1) maize and rye, with potatoes and some barley; (2) mainly oats and maize with some barley; (3) maize, barley, and oats; (4) rye, maize, oats, and some barley; (5) barley and maize, with rye and potatoes.

Two sheep were fed with a mixture of hay and each of the above residues in succession. It was found that the digestibility of the residues greatly varied, the difference being considerable even when the chemical composition was similar. The digestibility cannot be judged either from the nature of the products from which the residues are produced, or from the chemical composition. For the purpose of valuation, the amount and digestibility of the proteids should be ascertained.

The great variation in the digestibility coefficients of the proteids (49—79·5) depends chiefly on the temperature and time employed in drying the residues. Residues such as those which contain chaff, and are consequently readily dried, are more digestible, as regards proteids, than the more doughy ones. The fat was, in every case, nearly all

(92—94 per cent.) digested, and the non-nitrogenous extract was in some cases to a great extent digested. N. H. J. M.

Requirement of Food and Energy of Full-grown Fattened Bullocks. By OSCAR KELLNER and A. KÖHLER (*Landw. Versuchs-Stat.*, 1898, **50**, 245—296).—The results of previous experiments indicated that the weight of fattened animals can be maintained with rations corresponding with maintenance feeding, but did not prove that the substitution of fattening rations by maintenance food does not result in a loss of flesh or fat. Loss of fat would be accompanied by gain in water. The experiments now described were made with three fat bullocks, and lasted 15 or 16 days. The fæces were examined every 12, the urine every 24 hours, whilst the respired gases (carbonic anhydride and methane) were determined 4 or 5 times during a period of exactly 24 hours.

As regards the amounts of food constituents necessary to maintain full grown, fat bullocks in good condition, it is concluded that 0·85 kilo. of crude proteid, and 6·64 kilos. of non-nitrogenous food, per 1000 kilos. live weight, are sufficient. This includes 13 grams of proteid, and an amount of non-nitrogenous substance corresponding with 106 grams of fat, available for the continuous production of hair, hoofs, and skin, &c. Wolff's figures (digestible crude proteid, 0·75 kilo., and non-nitrogenous substance, 8·25 kilos.) may, therefore, be adhered to in practice, and it is only necessary to give the food in the form most readily consumed by the animals. The substance gained during fattening is not only not lost, but there is a slight further gain of fat. Any disturbance of the animals must be avoided, and the change of fattening to maintenance food must not be too sudden. Finally, the animals must always be kept in stalls with plenty of litter.

Deducting the heat values of the fæces, the urine, and the methane from that of the food, the average result for the three bullocks was found to be 24979 Cal., with a temperature of 15·7° in the stalls. Fattened animals would thus seem to require a slightly greater amount of energy supplied than lean animals, which may be accounted for on the supposition that a given amount of mechanical work requires greater exertion on the part of a fat than of a lean animal of equal muscular power. The difference is, however, only slight, and need not be taken into account in practice.

When food, both readily digestible and as palatable as possible, is given to cattle *ad lib.*, not only is the fattening period reduced, but less food is required than with smaller rations. N. H. J. M.

Sugar as a Food. By AUGUSTE CHAUVEAU (*Compt. rend.*, 1898, **126**, 795—802).—The general conclusions arrived at in this paper are as follows. The quantities of sugar, or of fat, that it is necessary to add to a given ration of meat in order to obtain the best diet for a man in work are not isodynamic quantities. An energy value of 0·756 in sugar is generally as effective as an energy value of 1·0 in the form of fat, and under some conditions the advantage of sugar may be still greater. In the case of sugar, the ratio of nutritive value to energy value is not constant, but may increase considerably when new tissues are being formed or an exhausted organism is being revivified, whereas in the case of fat the ratio remains practically constant. The increase in the relative nutritive value of the sugar is due to the fact that it promotes assimilation of proteids and reduces dissimilation. It follows that if it is misleading to deduce the nutritive value of a food simply from its heat of combustion, it is equally wrong to deduce this value exclusively from the facility with which the food is converted into muscular glycogen. As a matter of fact, the nutritive value of a food depends, not only on the energy that it is capable of supplying, but also on the indirect influence that it is capable of exerting in the renewal and formation of the anatomical elements of the body. From whatever point of view the matter is regarded, however, the superiority of sugar over fat is very distinct.

The author has reason to believe that these conclusions apply in the case of men at rest as well as in the case of men at work.

C. H. B.

Sulphuric Acid in Bone Ash. By P. BIELFELD (*Zeit. physiol. Chem.*, 1898, **25**, 350—354).—Mörner attributes the sulphuric acid found in bone ash, not to collagen, but to chondroitin-sulphuric acid. The high percentage given by some observers is due to the use of coal gas in the process of incineration. This last fact is confirmed in the present research, which is devoted to the examination of the question in fœtal bones. The quantity of sulphuric acid in ox bone is 0·04, in calf embryos 0·06 per cent. W. D. H.

The Antecedents of Urea. By JOHN T. HALSEY (*Zeit. physiol. Chem.*, 1898, **25**, 325—336).—Hofmeister (*Arch. exp. Path. Pharm.*, **37**, 426) showed that, by the oxidation of numerous organic substances, both nitrogenous and non-nitrogenous, by means of potassium permanganate in the presence of excess of ammonia, urea was formed. Among the substances employed were derivatives of methane, amido-acids, proteids, hydroxy-acids of the fatty series, glycol, pyrogallol, acetone, and oxamic acid. Ethylic alcohol, acids of the acetic and oxalic series and their amides (except formamide), acetonitrile, formaldehyde, dextrose, and a number of other substances yield no urea under these conditions.

In the present research, it is shown that, in the cases where urea is formed, formamide and oxamic acid are intermediate stages in the process; there are probably other substances as well. Experiments on dogs lead to the conclusion that these substances are rapidly transformed into urea. W. D. H.

Partial Decomposition of Chloroform in the Animal Organism. By ALEXANDRE DESGREZ and MAURICE NICLOUX (*Compt. rend.*, 1898, **126**, 758—760).—Experiments with dogs show that, although the gas obtained from normal blood contains carbonic oxide to the extent of about 1·6 c.c. per litre of blood, the proportion of this gas is very markedly increased when anæsthesia is produced by means of chloroform, and may amount to as much as 6·9 c.c. when the anæsthesia is intense and prolonged. The proportion of carbonic oxide increases with the duration of the anæsthesia, other conditions being equal.

On the other hand, when ether is the anæsthetic, there is a reduction instead of an increase in the quantity of combustible gases obtained from the blood. C. H. B.

Theory of Acid Poisoning. By HEINRICH WINTERBERG (*Zeit. physiol. Chem.*, 1898, **25**, 202—235).—Salkowski concluded from his own experiments (*Virchow's Archiv.*, 1873, **58**, 134) and from those of Gaehtgens (*Centr. med. Wiss.*, 1872, No. 53) that there was a difference in the chemical organisation of herbivorous and carnivorous animals, because the latter are more immune to mineral acids than the former; this he attributes to the capacity the carnivora have of excreting an increased amount of fixed alkali to neutralise the acid. Later observers (Walter, *Arch. exper. Path. Pharm.*, 1877, **7**, 148; Hallervorden, *ibid.*, 1879, **10**, 125) are inclined to attribute this difference to the amount of ammonia rather than fixed alkali. The present research shows that there is no real difference between the two classes of animals, herbivora also having the power of secreting an increased quantity of ammonia to neutralise the excess of acid; there is, however, a quantitative difference between the two classes, in favour of the carnivora.

The amount of ammonia excreted is, within narrow limits, independent of the reaction of the food given, but depends on the amount of ammonium salts not converted into urea.

The diminution of the carbonic anhydride in the blood is the sum of the absolute and relative amounts of alkali, there being a direct relation between the amount of carbonic anhydride and the alkalinity of the blood. W. D. H.

New Method of Disinfection. II. By REINHOLD WALTHER and ARTHUR SCHLOSSMAN (*J. pr. Chem.*, 1898, **57**, 512—534. Compare this vol., ii, 349).—A detailed description of the method already described (*loc. cit.*) is here given, including an account and sketch of Luigner's apparatus for dispersing the "glycoformal."

The authors discuss at some length the demands that are, and ought to be, placed on a disinfectant, and conclude by stating that although the above is not a perfect means of disinfecting, yet it approaches the ideal more nearly than any other known method. A. W. C.

Chemistry of Vegetable Physiology and Agriculture.

Assimilation of Nitrogen by Phanerogamous Plants from Amines, Substituted Ammonium Salts, and Alkaloids. By L. LUTZ (*Compt. rend.*, 1898, **126**, 1227—1229).—Experiments made under conditions precluding the action of micro-organisms show that phanerogams can obtain their nitrogen from amines of low molecular weight, such as methylamine and ethylamine, whereas benzylamine, pyridine, and betaine are incapable of assimilation. Substituted ammonium salts and alkaloids are also useless, whilst phenolic amines are powerfully toxic. When placed in a medium containing nitrogen in a form incapable of being utilised, the plants were found to lose, in the gaseous state, a considerable part of the nitrogen which they originally contained. N. L.

Examination of some cheap black Chinese Teas. By J. Zolcinski (*Zeit. anal. Chem.*, 1898, **37**, 365—374).—The author has estimated moisture, caffeine, total nitrogen, total soluble matter, and ash in a number of cheap teas, and also determined the sp. gr. of an extract made with 10 parts of boiling water. Comparing his results with those of König, Weyrich, Geissler, and Bell, he concludes that the samples were all genuine and of good quality. The average amount of caffeine found was 1·55 per cent., and the average sp. gr. of the extract 1·0088 at 15°. M. J. S.

Composition of Polenta made from Sound and Unsound Maize Flour. By Deodato Tivoli (*Gazzetta*, 1898, **28**, i, 64—78).—The prevalence of pellagra in Italy has been attributed to the eating of polenta made with unsound maize flour. The author has, therefore, examined polenta made from the sound and unsound flour in order to ascertain whether marked differences in composition exist; the water lost at 100°, the acidity, the total nitrogen, the nitrogen in the soluble and insoluble constituents, the percentage extracted by ether and by water, the reducing power, the ash, the ash from the aqueous solution, the sodium chloride, and the cellulose were all determined.

Sound polenta contains rather less albuminoid nitrogen, and is much less acid in reaction than unsound; less ethereal extract or fatty matter is obtained from unsound polenta, and the power of reducing Fehling's solution is greater in the unsound polenta. The unsound polenta yields less ash, and contains much less sodium chloride, more matter soluble in water, and slightly less cellulose than sound polenta. W. J. P.

Some Soils rich in Potash. By Arthur Bornträger and G. Paris (*Landw. Versuchs-Stat.*, 1898, **50**, 343—345).—Soils of volcanic origin are rich in potash a part of which is soluble in water. Casoria found considerable amounts of potash in waters near Vesuvius (*Ann. R.. Scuola. Sup. Portici.*, 1885, **5**, part i).

The following analyses are given of four volcanic soils from the neighbourhood of Vesuvius. The mineral matter was extracted with boiling hydrochloric acid (sp. gr. = 1·12).

	Humus.	Nitrogen.	K_2O.	CaO.	P_2O_5.	Insoluble.
1.	—	0·0252	4·234	—	0·417	66·38
2.	—	0·3934	4·379	—	0·303	65·53
3.	—	1·00	5·050	—	0·684	64·80
4.	2·86	0·33	2·710	8·11	0·350	—

The soils contained only small quantities or traces of carbonates and sulphates, not much magnesia, but a good deal of lime and iron. Nos. 1 and 3 contained a little humus, No. 2 more.

N. H. J. M.

Effect of Crops and Manures on the Nitrogen Content of the Soil. By Chr. Fr. A. Tuxen (*Landw. Versuchs-Stat.*, 1898, **50**, 334—342).—Field experiments on rotation, permanent barley and permanent meadow have been made since 1863 at the Copenhagen Agricultural High School. The experiments included in each case an unmanured plot, and plots which received stable manure (18,000 kilos. until 1872, and 36,000 kilos. since) and artificial manures (nitrogen, 40·2; soluble phosphoric acid, 40; and potash 97 kilos. per hectare) respectively. Soil samples were taken, in 1886 and again in 1894, to the depth of 10 cm. and 10—20 cm., the method adopted being that employed at Rothamsted. Five samples were taken on each plot. The following summary shows the amount of nitrogen to the depth of 20 cm. in kilograms per hectare (1 kilogram per hectare = 0·89 lb. per acre).

	Meadow.		Barley.		Rotation.	
	1886.	1894.	1886.	1894.	1886.	1894.
Unmanured	4931	4638	3578	3470	4407	5025
Artificial manures	5131	5010	3639	3403	4582	5185
Stable manure	5842	6793	4596	4804	4593	6164

The soil is loamy, with a loam subsoil.

The yield of hay diminished after some time, increased in 1884, but since 1886 the yield was inconsiderable; this is owing chiefly to unfavourable climatic conditions. Barley and the rotation crops have, however, not fallen off to any extent.

As regards the amount of nitrogen in the soil, the herbage of the permanent meadow had the most favourable effect, due partly to the leguminous plants, and partly to the retention of nitrogen compounds supplied by the rain, which amounts in Denmark to 15 kilos. of nitrogen per hectare per annum. Moreover, in the case of meadow land, which remains cooler and drier in the summer than land more or less bare, nitrification is more or less diminished, whilst the comparatively small amount of nitrate formed is at once assimilated without loss.

The rotation land, whether manured or not, contained about 900 kilos. of nitrogen more than the barley land after 22 years, and very much more after 30 years.

Comparing artificial nitrogenous manure (in this case ammonium sulphate) with farmyard manure, the results show that only the latter enriches the soil to any extent. N. H. J. M.

Analytical Chemistry.

Graduated Apparatus. By A. Hémot (*Bull. Soc. Chim.*, 1897, [iii], **17**, 343—344).—Flasks and pipettes are marked with a scale of temperatures, so as to allow of the measurement, at any temperature between 4° and 30°, of a quantity of water which shall occupy a standard volume at 4°. N. L.

Caution against Alkali Glass. By Carl T. Liebermann ((*Ber.*, 1898, **31**, 1818).—Attention is drawn to the large proportion of soluble alkali occurring in certain sorts of alkali glass. M. O. F.

Determination of the Specific Gravity of Small Quantities of Gas. By Th. Schlœsing, jun. (*Compt. rend.*, 1898, **126**, 896—899).—The author has applied his apparatus (this vol., ii, 324, 325), as a manometer, to the determination of the solubility of carbonic anhydride in sulphuric acid with the following results.

100 c.c. of acid of sp. gr. 1·845 dissolve, at 11·3°, 111 c.c. and at 30·2°, 77 c.c. of carbonic anhydride.

100 c.c. of acid of sp. gr. 1·733 dissolve, at 10·7°, 43 c.c. and at 30·2°, 27 c.c. of carbonic anhydride.

In order to make the apparatus applicable to all kinds of gases, the tube containing the gas to be examined is divided into three parts, horizontal serpentines of glass tube being inserted between the first and second and the second and third. In making an experiment, the lowest section of the tube is filled with carbonic anhydride, and the middle section with the gas under examination, whilst the upper section, as well as the second tube of the apparatus, remain filled with air. Under these conditions, any interdiffusion of the gas experimented on with either the carbonic anhydride or the air takes place in the serpentines, and, since these are horizontal, does not affect the level of the gaseous columns. Moreover, the gas under examination, which occupies the middle section of the tube, always has the same vertical length, which can be measured once for all. Determinations of the sp. gr. of nitrogen, carbonic anhydride, and sulphurous anhydride made with this apparatus agree with those made by older methods. C. H. B.

Apparatus for the Extraction of large Volumes of Liquid with Ether. By Hans Malfatti (*Zeit. anal. Chem.*, 1898, **37**, 374—377).—The ether is boiled in a flask, and the condensed vapour falls into a kind of thistle-headed funnel, with a tube about a metre long inserted concentrically into a wider tube, through which the liquid to be extracted flows downwards in a continuous stream, being admitted by a side tube a little way below the top, and escaping at the bottom through an upturned tube rising about half the height of the column. The ether rises through the column of descending liquid, and overflows into the flask by a side tube inserted above the inlet for the other liquid. The contact of the two is prolonged by winding wool, or other suitable material, spirally round the inner tube. A drawing of the apparatus accompanies the paper. M. J. S.

Inaccuracies in the Estimation of Carbon and Hydrogen by Combustion. By CHARLES F. MABERY (*J. Amer. Chem. Soc.*, 1898, **20**, 510—513).—The author has proved by a number of combustions of petroleum that the ordinary form of potash-bulb loses moisture, an additional sulphuric acid tube still showing an increase in weight amounting to 1—2 milligrams. Another difficulty experienced was the presence of carbonaceous impurities in the granular copper oxide. If this is heated for several hours in pure oxygen, it is obtained quite free from impurities. L. DE K.

The Error in Estimations of Carbon where Weighed Potash-bulbs are Employed. By GEORGE AUCHY (*J. Amer. Chem. Soc.*, 1898, **20**, 528—534).—The author again confirms the statement that it is very difficult to obtain good results with carbon estimations in damp weather.

Blair's proposal to correct the error by placing an empty potash-bulb on the opposite pan, which might be supposed to condense the same amount of moisture on its surface, has been found to be illusory. The tabulated results show that it is impossible to get anything like true blanks in very damp weather.

The true remedy will, no doubt, be found in the use of smaller potash-bulbs or the substitution of soda-lime tubes. L. DE K.

Absorption of Oxygen by Potassium Pyrogallol. By MARCELLIN P. E. BERTHELOT (*Compt. rend.*, 1898, **126**, 1066—1072).—The author has made experiments with a view to ascertain under what conditions alkaline pyrogallol will absorb oxygen without liberating carbonic oxide.

A solution of 32 grams of pyrogallol in 100 c.c. of water, mixed with rather more than three equivalents of potassium hydroxide, will absorb ninety-two times its volume of oxygen, the absorption being at first rapid and afterwards slow. The volume of carbonic oxide liberated is about one seventy-fifth of the oxygen absorbed. The results are the same whether the oxygen is added all at once or in successive small portions, and are not appreciably affected by difference of temperature between 15° and 62°. Variations in the concentration of the alkali solution between somewhat wide limits affect neither the final result nor the relative velocity of the reaction; moreover, it is practically the same whether the pyrogallol is mixed with one equivalent of potassium hydroxide or with three, but if only half an equivalent of the hydroxide is added, the absorption of oxygen is also reduced to one-half, whilst the proportion of carbonic oxide liberated increases.

The proportion of carbonic oxide liberated is reduced to a minimum when the pyrogallol is mixed with a considerable excess of alkali, and when the quantity used is sufficient to absorb four or five times as much oxygen as it is placed in contact with.

When the reaction reaches its limit, three atoms of oxygen are absorbed for each molecule of pyrogallol present. C. H. B.

NOTE BY ABSTRACTOR.—The fact that no carbonic oxide is liberated when potassium hydroxide is present in considerable excess has previously been observed by Clowes (Proc., 1895, 200).

Determination of Sulphur in Illuminating Gas. By ANTONIO LONGI (*Gazzetta*, 1898, **28**, i, 1—11).—The author has devised a modification of the apparatus used by Drehschmidt for the determination of sulphur in coal gas; the new apparatus, which is described in detail, is constructed wholly of glass, so as to avoid danger of the sulphuric acid produced attacking the metal in the lamp chimney, and is comparatively inexpensive. The lamp burns 10—15 litres of gas per hour, and the products of combustion are drawn by a water pump through two absorption cylinders filled with glass beads moistened with a solution of bromine in potassium carbonate; after the combustion has been effected, the sulphuric acid is estimated as barium sulphate in the liquor rinsed from the beads. The air serving for the combustion is purified by passing it through a tower containing pumice saturated with potassium carbonate and potassium permanganate.

Test analyses, made by burning hydrogen previously passed over weighed quantities of heated silver sulphide or silver thiocyanate, show the method to be accurate. W. J. P.

Apparatus for the Estimation of Free Nitrogen in Purified Coal-gas. By GEORGES ARTH (*Bull. Soc. Chim.*, 1897, [iii], **17**, 427—432).—The gas under examination is contained in a glass holder, where it is measured at a known temperature and pressure, and from which it is expelled by water. It is then passed through concentrated sulphuric acid to remove nitrogenous basic compounds, and burnt in an ordinary combustion tube charged with cupric oxide, the nitrogen being collected and measured as in Dumas' process. A current of carbonic anhydride is passed through the apparatus before and after the operation. A sketch of the apparatus in given. N. L.

Reactions of Carbonic Oxide. By ARMAND GAUTIER (*Compt. rend.*, 1898, **126**, 871—875).—Absorption with cuprous chloride is inapplicable to the determination of minute quantities of carbonic oxide, owing to the interference of acetylene and other hydrocarbons. Ammoniacal silver nitrate is also of comparatively little value, because the reaction varies with the concentration of the solution and its temperature; the oxidation is frequently incomplete, and the silver nitrate is reduced by gases other than carbonic oxide.

Oxidation of the carbonic oxide by potassium permanganate in presence of silver salts, as recommended by Mermet, is open to the objection that many other gases act on the reagent in a similar manner.

Chromic acid in concentrated aqueous solution oxidises carbonic oxide incompletely, even in presence of sulphuric acid. Potassium permanganate solution, 1 gram per litre, oxidises carbonic oxide very slowly, but a solution of 10 grams per litre acts very much more rapidly, even in the cold, carbonic anhydride and non-volatile acids being formed.

A solution of iodic acid containing 10 grams per litre has no action on the gas in the cold, but with a solution of 100 grams per litre at 100° there is a distinct reaction, with liberation of iodine and production of carbonic anhydride. The reaction with iodic anhydride recommended by Ditte (compare Nicloux, below) is quantitative, begins at 40°, or even below, and is rapid and complete at 60°.

Gold chloride solution (1 in 100) is an excellent reagent for carbonic oxide, the reaction being almost instantaneous even in the cold, whilst the purple reduced gold settles rapidly. It is essential that the air tested with this reagent should be free from dust and contain no other reducing gases.

Moist silver oxide slowly absorbs carbonic oxide with formation of silver subcarbonate, Ag_4CO_3, which is only slowly attacked by dilute acetic acid, but is completely decomposed by dilute sulphuric acid with liberation of carbonic anhydride, the other products being silver sulphate, metallic silver, and water. Traces of formic and oxalic acids are formed at the same time as the subcarbonate.

Mercuric and mercurous oxides seem to have no action on carbonic oxide. C. H. B.

Detection of Carbonic Oxide by means of Palladium Chloride. By POTAIN and RENÉ DROUIN (*Compt. rend.*, 1898, **126**, 938—940).—A solution of palladium chloride, 1 part in 10,000, may be used as a reagent for carbonic oxide, the air containing the gas being allowed to bubble in a very thin stream through 10 c.c. of the solution. If 10 litres of air are used, 1 part of carbonic oxide in 10,000 can be detected by the reduction of the chloride to metallic palladium, but the method does not lend itself to quantitative estimation.

Direct experiment shows that when mixtures of carbonic oxide with a large proportion of air are exposed to light, the carbonic oxide is gradually oxidised to carbonic anhydride, but the change is retarded and limited by the presence of carbonic anhydride. This observation probably explains why the proportion of carbonic oxide in the air of towns does not increase. C. H. B.

Estimation of Minute Quantities of Carbonic Oxide in Air. By MAURICE NICLOUX (*Compt. rend.*, 1898, **126**, 746—749).—The method proposed depends on the fact that, at 150°, carbonic oxide decomposes iodic anhydride, with liberation of iodine and formation of carbonic anhydride. The air to be examined is passed successively over potassium hydroxide and pumice moistened with sulphuric acid, and then through a U-tube containing iodic anhydride, and placed in an oil bath, this tube being connected with a Will's apparatus containing pure sodium hydroxide solution of sp. gr. 1·3 diluted with an equal volume of water. The air is aspirated through the tubes at the rate of about 10 c.c. per minute, and when the operation is completed the alkali solution is acidified with sulphuric acid, mixed with sodium nitrate, and agitated with 5 c.c. of chloroform, or, better, carbon bisulphide, the intensity of the rose tint being compared with that produced by known quantities of potassium iodide, $3CO = KI$. Air alone, hydrogen, and methane give no similar result, and the method is applicable to proportions of carbonic oxide varying from 1 in 1 000 to 1 in 50,000. C. H. B.

Estimation of Small Quantities of Carbonic Oxide in Air. By ARMAND GAUTIER (*Compt. rend.*, 1898, **126**, 793—795).—The reaction described by Nicloux (preceding abstract) has been employed in the author's laboratory for the estimation of small quantities of carbonic oxide during the last seven or eight years. It is applicable even when the gas is diluted with 20,000 vols. of air, and the reaction with the iodic anhydride proceeds regularly and completely at 60°, and also takes place at 40°, although slowly. At 60°, most hydrocarbons, with the exception of acetylene, have no action on the anhydride. The liberated iodine may be absorbed by copper and weighed, but the best plan is to estimate the carbonic anhydride by Muntz's method.

At temperatures higher than 60°, and especially at 150°, several hydrocarbons reduce iodic anhydride. Ethylene, although it does not directly attack the anhydride, has the peculiar property, even when present in small quantity, of preventing the oxidation of the carbonic oxide.

The *complete* liberation of iodine by nitrous acid takes place only under certain conditions. C. H. B.

Estimation of Carbonic Oxide in Air. By ARMAND GAUTIER (*Compt. rend.*, 1898, **126**, 931—937).—The oxidation of carbonic oxide by iodic anhydride begins at 30°, is rapid at 40° to 45°, and is complete at 60—65°, no matter how large a proportion of air or nitrogen the oxide may be diluted with. The volume of carbonic anhydride formed is always equal to that of the carbonic oxide taking part in the reaction, and it is best estimated by the volumetric method of Muntz and Aubin (Abstr., 1887, 468). Experiments with air containing known proportions of carbonic oxide show that the method is applicable when the proportion of the latter is so low as 1 part in 30,000, or even 1 part in 300,000.

Acetylene is oxidised by iodic anhydride, the reaction beginning at 35° even in presence of a large proportion of air. Ethylene is oxidised by iodic anhydride at 65°, and the presence of this gas interferes with the oxidation of carbonic oxide.

Methane and its homologues are not oxidised by the anhydride at 65—80°. C. H. B.

Estimation of Carbonic Oxide in Air and in Normal Blood. By LOUIS DE SAINT-MARTIN (*Compt. rend.*, 1898, **126**, 1036—1039).—In the author's method of estimating carbonic oxide (Abstr., 1892, 1128), the gas extracted from the cuprous chloride solution is measured before explosion, after explosion, and after treatment with potash; and from these data the composition of the gas can be calculated. There is, therefore, no risk of hydrocarbons being estimated as carbonic oxide, as Gautier supposes (compare preceding abstracts).

The author confirms the statement of Degrez and Nicloux (this vol., ii, 529) that carbonic oxide exists in small quantity in the normal blood of animals living in towns, but the quantity is less than 1 c.c. per litre. Great care is necessary to prevent confusion between carbonic oxide and hydrocarbons, and the author is unable to accept the statement of Degrez and Nicloux that the proportion of carbonic oxide in the blood is largely increased by the inhalation of chloroform.

C. H. B.

New Solvent for Distinguishing the Phosphoric Acid in various Phosphates. By Wilhelm Hoffmeister (*Landw. Versuchs Stat.*, 1898, **50**, 363—369).—Whilst Wagner and Maercker have shown that the phosphoric acid of bone meal is not to be compared in value with that of basic slag, and Wagner's citric acid solution extracts far more phosphoric acid from the latter than from the former when the action is continued for half an hour, a greater amount of phosphoric acid (to 99 per cent.) is obtained from bone meal when the action of the citric acid is prolonged to 5—6 days than from basic slag (to 90 per cent.).

The following method gives results more in accordance with the ascertained manurial value of the two products. Humic acid (15 grams) dissolved in dilute ammonia is poured into a 2-litre flask containing some sand; the manure (5 grams) and at least 1 litre of water are then added, the whole shaken, and a moderately strong current of carbonic anhydride passed through for 12 days; ammonia should be added frequently. The liquid is then poured off, the sand washed, and the combined liquids, made up to a definite volume, are filtered, and four-fifths of the filtrate evaporated to dryness, after addition of hydrochloric acid. The residue is treated with water containing a little hydrochloric acid, filtered, washed, and the filtrate made up to 100 c.c. Portions of this are employed for estimating phosphoric acid, iron, and lime.

Basic slag containing 16·7 per cent. citrate soluble phosphoric acid gave 10·43 and 10·38 per cent. soluble in humic acid. In bone meal, and fermented bone meal, 1·01 and 1·48 per cent. of phosphoric acid dissolved in humic acid. When, however, the basic slag is first rubbed with alcohol, results almost identical with Wagner's are obtained; P_2O_5 (citrate soluble) = 18·53; soluble in humic acid, 18·48 and 18·45 per cent.

The method is too complicated to supersede Wagner's for basic slag, but is intended to distinguish between different phosphates. Fine bone meal, in which the phosphoric acid almost entirely dissolves in citrate solution, only yielded 1 per cent. with humic acid. The results show the great importance of manufacturers supplying basic slag in the finest possible form.

Humic acid dissolved the following percentages of the total phosphoric acid of different manures. Basic slag (fine), 95·8; Redonda phosphate, 30·38; bone precipitate, 43·3 per cent.

The humic acid is prepared from wood-lignin by extraction with ammonia vapour. N. H. J. M.

Estimation of Potassium without previously Removing the Iron, Calcium, &c. By Charles C. Moore (*J. Amer. Chem. Soc.*, 1898, **20**, 340—343).—The solution, which must be free from ammoniacal salts, but may contain iron or aluminium chlorides and alkali sulphates, is mixed with sufficient platinum tetrachloride to insure the precipitation of the potassium, and the whole evaporated to a syrupy consistency; the residue is then treated with acidified alcohol, which dissolves the excess of platinum tetrachloride, and also the ferric and aluminium chlorides. When these compounds have been completely removed, the sodium sulphates and chlorides are washed out with a 20 per cent. solution of ammonium chloride, and after this has been removed by means of 85 per cent. alcohol, the potassium platinochloride is dried and weighed as usual.

The acidified alcohol is prepared by passing dry hydrogen chloride into cold 90 per cent. alcohol until 1 c.c. neutralises 2·3 c.c. of normal alkali. L. DE K.

Estimation of Lead in Alloys. By W. E. GARRIGUES (*J. Amer. Chem. Soc.*, 1898, **20**, 508—510).—The process is based on the fact, noticed by the author, that lead chromate is not affected by ammonia, whereas copper chromate is readily soluble in it.

The nitric acid solution containing the lead and the copper is mixed with an excess of potassium dichromate, followed by ammonia in excess. After heating until the liquid clears, the lead chromate is collected on a Gooch crucible, and after being washed, first with dilute ammonia, then with hot water, and finally with alcohol, is dried in the water oven and weighed.

The author also communicates a process which admits of the estimation of the lead as sulphate, without previously removing any tin which may be present. About 0·5 gram of solder, for instance, is oxidised with nitric acid, 20 c.c. of sulphuric acid is added, and the solution is evaporated until dense sulphuric fumes appear. Eighty c.c. of water is then added, and after a few minutes the lead sulphate is collected on a Gooch crucible. The filtrate contains the tin in solution, which may be precipitated as hydrated oxide, by adding ammonia until it is alkaline, and then sulphuric acid until the liquid is faintly acid. L. DE K.

Note on Drown's Method of Estimating Silicon in Steel. By GEORGE AUCHY (*J. Amer. Chem. Soc.*, 1898, **20**, 547—549).—The author has slightly modified Drown's process; 4·6667 grams of the sample of steel is treated in a beaker with 50 c.c. of a mixture of 500 c.c. of dilute nitric acid (2 : 3), 300 c.c. of sulphuric acid, and 200 c.c. of water. When the steel has dissolved, 15 c.c. of strong hydrochloric acid is added, a watch-glass is suspended over the beaker by three small, bent glass rods, and the liquid boiled down rapidly over a very hot iron plate, until fumes of sulphuric acid begin to appear. By this simple modification, the silicic acid is completely dehydrated, which is not the case if no hydrochloric acid is used. L. DE K.

Analytical Notes on the Estimation of Phosphorus in Steel. By R. W. MAHON (*J. Amer. Chem. Soc.*, 1898, **20**, 429—453). This is a very elaborate article on the vexed question as to what should be considered the best way of proceeding when testing steel for phosphorus by the molybdate method. It is again proved that long standing is of no advantage when Fresenius's molybdate solution is used for estimating phosphoric acid: the precipitation is complete within 10 minutes. It appears also, from a large number of experiments, that too much stress cannot be laid on the necessity of adding the magnesia mixture slowly. Other interesting details are given.

L. DE K.

Use of Hydrofluoric Acid in the Estimation of Manganese in Iron and its Ores. By ALLEN P. FORD and I. M. BREGOWSKY (*J. Amer. Chem. Soc.*, 1898, **20**, 504—506).—The process based on the conversion of the manganese into manganese dioxide by treating samples of iron with nitric acid and potassium chlorate has this disadvantage, that much silicic acid is also precipitated, and causes inconvenience by clogging the filter. The authors now recommend adding a few drops of hydrofluoric acid, which instantly dissolves the silica; the use of this acid renders the beakers somewhat unsightly, but does not prevent them from being used a long time for the same kind of work.

In testing ores by the chlorate method, it has always been noticed that the precipitation of the manganese is never complete in one operation, but that the filtrate must always be tested again. The authors now state that when hydrofluoric acid is used, the precipitation is at once complete. L. DE K.

Antimonic Tungstates: Separation of Tungsten and Antimony. By L. A. HALLOPEAU (*Bull. Soc. Chim.*, 1897, [iii], 17, 170—175. Compare Abstr., 1897, ii, 178).—To estimate antimony in antimoniotungstates, the solution is mixed with mercurous nitrate and the precipitate of mercurous antimoniotungstate collected, washed, and ignited. The mixture of tungstic acid and antimony tetroxide thus obtained is fused with a large excess of potassium cyanide, when the antimony is reduced to the metallic state, and is eventually washed with water and dilute alcohol, dried at 100°, and weighed. N. L.

Applications of Hydrogen Peroxide to Quantitative Analysis. By PERCY H. WALKER (*J. Amer. Chem. Soc.*, 1898, **20**, 513—515).—*Separation of Titanium from Iron.*—The solution, which should measure about 150 c.c. and contain about 0·2 gram of the mixed metals, is mixed with 100 c.c. of a 2·5 per cent. solution of hydrogen peroxide and run in from a dropping funnel into a large beaker containing 100 c.c. of hydrogen peroxide and 30 c.c. of strong ammonia. The iron precipitate is washed with dilute ammonia to which some hydrogen peroxide has been added, but, as it still retains a considerable amount of titanium, it should be dissolved in a little hydrochloric acid and again treated with ammoniacal hydrogen peroxide; it is advisable to treat it in this way a third time. The mixed filtrates are boiled to precipitate the titanium as hydroxide, which is then washed with hot solution of ammonium nitrate and converted into oxide by ignition.

Separation of Uranium from Iron.—The slightly acid solution containing about 0·2 gram of the mixed metals is treated with 50 c.c. of hydrogen peroxide, and run slowly into a solution of 5 grams of sodium hydroxide in 50 c.c. of water containing 50 c.c. of hydrogen peroxide; the whole is then diluted with hot water to about 400 c.c. and filtered. The filtrate, which contains all the uranium, is acidified with hydrochloric acid and evaporated to dryness at 110°, and the uranium finally precipitated from the hydrochloric acid solution by ammonia and weighed as oxide.

Separation of Zirconium from Uranium.—About 0 3 gram of the mixed metals is fused with 7 grams of sodium pyrosulphate, the melt dissolved in cold water, and the solution, mixed with 50 c.c. of hydrogen peroxide, is poured into a mixture of sodium hydroxide and hydrogen peroxide; on heating for half an hour on the water bath, the zirconium is gradually precipitated. After washing it with hot water, it is dissolved in a mixture of hydrochloric acid and hydrogen peroxide, boiled, and then precipitated with ammonia. The zirconium is finally weighed as oxide. L. DE K.

Colorimetric Estimation of Small Amounts of Chromium in Rocks and Ores. By WILLIAM F. HILLEBRAND (*J. Amer. Chem. Soc.*, 1898, **20**, 454—460).—The author has invented a very accurate process for the estimation of chromium in minerals when it only occurs in small quantity; 5 grams of the mineral, which often contains vanadium as well as chromium, is fused in a platinum crucible with 20 grams of sodium carbonate and 3 grams of sodium nitrate, avoiding too high a temperature. The melt is treated with hot water and a few drops of alcohol to reduce any manganese, and the solution filtered and nearly neutralised with nitric acid. On heating, the bulk of the silica and alumina separates; but, as this may retain some chromium, it should be treated with hydrofluoric and sulphuric acid to remove the silica, and the residual alumina must then be again fused with the oxidising mixture. To the mixed filtrates, mercurous nitrate is added, and the precipitate, after being ignited, is fused with a little soda; the melt is then dissolved in water, filtered, and diluted to 50 or 100 c.c. The yellow liquid is now introduced into a special colorimetric apparatus devised by the author, but ordinary Nessler tubes also answer the purpose. For comparison, a solution is used containing 0·25525 (or double) gram of pure potassium chromate in one litre of water rendered alkaline with sodium carbonate; each c.c. of the solution represents 0·1 milligram of chromic oxide.

If the amount of chromium exceeds 0·2 per cent., the treatment with nitric acid and mercurous nitrate may be omitted. L. DE K.

Volumetric Estimation of Vanadium in Presence of Small Amounts of Chromium, with Special Reference to the Analysis of Rocks and Ores. By WILLIAM F. HILLEBRAND (*J. Amer. Chem. Soc.*, 1898, **20**, 461—467).—The precipitate produced by mercurous nitrate (preceding abstract) also contains any vanadium present, which passes into the alkaline solution along with the chromium. The amount of chromium is first estimated colorimetrically, and it is then reduced to the chromic state by adding sulphuric acid and sulphurous acid, which also reduces the vanadium. After boiling off the excess of sulphurous acid and cooling to 80°, the vanadium may be titrated with standard permanganate. As, however, at that temperature, the chromic oxide also reduces the permanganate, a check must be made on a liquid containing exactly the same amount of reduced chromate, and the number of c.c. of permanganate must then be deducted from those used in the previous experiment. The test analyses are satisfactory.

L. DE K.

Method for the Differentiation of Organic Matter in Water. By A. G. Woodman (*J. Amer. Chem. Soc.*, 1898, **20**, 497—501).—The process is based on the fact, already noticed by Barnes, that some organic matters are more readily oxidised by chromic acid than by permanganic acid.

In order to differentiate between the organic impurities of water, the author first uses Kubel's hot acid method, as follows. One hundred c.c. of the sample is mixed with 8 c.c. of dilute sulphuric acid (1 : 3), 10 c.c. of N/100 potassium permanganate is added, and the whole boiled for exactly 5 minutes; 10 c.c. of N/100 oxalic acid is added, and then titrated back with N/100 permanganate until the faint pink colour becomes permanent. To another portion of the sample, the chromic acid method is then applied. 6·2 grams of potassium dichromate is dissolved in distilled water, 50 c.c. of sulphuric acid added, and the solution diluted to 1 litre; 18 grams of ferrous sulphate is dissolved in 100 c.c. of sulphuric acid and 200 c.c. of water, and diluted to 500 c.c. Fifty c.c. of the sample is mixed with 20 c.c. of sulphuric acid, then with 10 c.c. of the chromic acid solution, and heated on the boiling water bath for 1 hour, the flask being covered with a watch-glass. Ten c.c. of the iron solution is added, the liquid is poured into 500 c.c. of cold water, and titrated with the permanganate solution. A blank experiment is, of course, made. The oxygen ratio is found by dividing the number of c.c. of permanganate used in the Kubel process by those used for the same amount of water in the chromic acid method.

The ratio for vegetable organic matters is over 0·6, whilst that of sewage matter falls considerably below that figure. L. de K.

Estimation of Nitrites in Waters. By Lucien Robin (*J. Pharm.*, 1898, [vi], 7, 575—577).—The water should be clear, colourless, and free from hydrogen sulphide; 50 c.c. of the water is mixed with 2 c.c. of a 20 per cent. solution of pure potassium iodide, and after well shaking 2 c.c. of glacial acetic acid is added, the free iodine is then estimated by the aid of thiosulphate. The method is applicable to waters containing 0·1 mg. of nitrous acid per litre. J. J. S.

Estimation of Methane, Carbon Monoxide, and Hydrogen by Explosion, in Technical Gas Analysis. By William A. Noyes and J. W. Shepherd (*J. Amer. Chem. Soc.*, 1898, **20**, 343—345).—The authors point out the difficulty experienced in the direct estimation of carbon monoxide by means of cuprous chloride, and prefer to analyse the mixture by explosion. This may be done by exploding the unconsumed part of the added oxygen by means of added hydrogen.

A new form of pipette has been introduced which allows of the explosion taking place in a perfectly closed space. The water in the pipette is mixed with a little sulphuric acid, which greatly diminishes the solubility of carbonic anhydride. The outer end of the capillary tube of the Orsat apparatus has been fitted with a specially constructed small hydrogen generator in which the gas is generated from aluminium and aqueous potash.

If ordinary gas has to be tested, its carbonic anhydride is absorbed by potash, its heavy hydrocarbons by fuming sulphuric acid, and its oxygen in an alkaline solution of pyrogallol. Atmospheric air is then introduced, the mixture exploded, and after ascertaining the amount of carbonic anhydride formed, hydrogen is admitted and the excess of oxygen estimated. Allowance must be made for the nitrogen contained in the air, which is assumed to contain 20·9 per cent. of oxygen. The method of calculation will be easily understood by analysts accustomed to this kind of work. L. DE K.

Examination of Eucalyptus Oil. By HELBING and PASSMORE (*Zeit. anal. Chem.*, 1898, **37**, 404—405; from Helbing's *Pharmacolog. Record*, VIII.)—A eucalyptus oil for therapeutic purposes should be characterised by a high percentage of eucalyptol and the absence of volatile aldehydes, which would irritate the mucous membrane. The sp. gr. should be between 0·910 and 0·930 at 15°. Eighty per cent. of the oil should distil between 170° and 190°, and on cooling to 16°, 40—50 per cent. of eucalyptol should crystallise out. This, after washing with a little light petroleum and drying, should melt at 5° and boil at about 176°; its sp. gr. is between 0·922 and 0·924 at 15°, and in a 100 mm. tube it should not rotate the plane of polarised light more than half a degree in either direction. The first fractions of the distillate should be tested with sodium hydrogen sulphite for aldehydes and ketones. Of seven samples examined, one (French) contained no eucalyptol, and one (Californian) only 1·8 per cent. Another specimen (Spanish) contained much aldehyde. M. J. S.

Distillation of Dilute Aqueous Solutions of Ethylic Alcohol. Estimation of Alcohol therein. By MAURICE NICLOUX and L. BAUDUER (*Bull. Soc. Chim.*, 1897, [iii], **17**, 424—427).—Three dilute solutions of alcohol (1 : 500, 1 : 1000, and 1 : 3000) were distilled, and the alcohol contained in the different fractions of the distillate was estimated. The results obtained are given in tabular form, and are also represented by curves. It appears that the rapidity with which the alcohol distils over increases with the dilution, the first fourth of the distillate from the most dilute solution (1 : 3000) containing practically the whole of the alcohol present, whereas, in the case of the 1 : 500 solution, about 7 per cent. of the alcohol remained in the retort after a third of the liquid had passed over. The first twentieth contained, in each case, about half the total alcohol present. The alcohol in still more dilute solutions (up to 1 : 10,000) may be estimated by distilling over a fourth part and then applying the volumetric process, based on the oxidation of the alcohol by potassium dichromate, which has been previously described by one of the authors (*Compt. rend. Soc. biol.*, [x], **3**, 841). N. L.

Estimation of Small Quantities of Glycerol. By MAURICE NICLOUX (*Bull. Soc. Chim.*, 1897, [iii], **17**, 455—458).—The author points out some errors which Bordas and de Raczkowski have made in the application of his process for the estimation of alcohol to the estimation of glycerol (Abstr., 1897, ii, 193). When oxidised by excess of potassium dichromate and sulphuric acid, glycerol yields only carbonic anhydride and water, and not formic acid; the latter is immediately oxidised by the chromic acid, even in very dilute solution. The standard chromate solution should theoretically contain 37·28 grams of potassium dichromate per litre, and not 48 grams as stated by Bordas and Raczkowski. This has been confirmed practically by experiments with pure glycerol; 1 c.c. of the solution is equivalent to 5 c.c. of a 0·1 per cent. solution of glycerol. N. L.

Quantitative Separation of Hemicellulose, Cellulose, and Lignin. Presence of Pentosans in these Substances. By WILHELM HOFFMEISTER (*Landw. Versuchs-Stat.*, 1898, **50**, 347—362. Compare this vol., ii, 148).—The separation of the cellulose-like carbohydrates of sunflower husks, is described.

In order to ascertain the effect of dilute ammonia on the cellulose substances of lignin, a dried 5 per cent. caustic soda extract was extracted successively with 1, 2, 3, and 4 per cent. sodium hydroxide solution. Five grams of the 2 per cent. extract was then subjected to the action of ammonia vapour; the cellulose did not completely dissolve in 6 weeks. Cellulose insoluble in caustic soda (32 grams) was next extracted with ammonia, in a similar manner, for 10 days, dried, and weighed. 30·46 grams remained, which, when treated with 5 per cent. aqueous caustic soda, yielded 0·96 gram (= 3 per cent.) of hemicellulose.

When cellulose is dissolved in Schweizer's solution, the residue is, by repeated extraction with aqueous sodium hydroxide, completely converted into the soluble form. On evaporating the ammonia from the Schweizer's extract, at the ordinary temperature, and on a water bath respectively, different amounts of cellulose are obtained; more hemicellulose is obtained, by caustic soda, from the heated solution than from that which was not heated. In this operation, the pentosans are more influenced than the hexosans; pentosans are not always readily dissolved by caustic soda, and hexosans are frequently more or less readily dissolved. Both occur in lignin and are then undoubtedly indigestible. These points have to be considered in judging the digestibility of these carbohydrates.

A comparison of analyses of clover, at different periods, in the first and second years of growth, shows that both cellulose (Schweizer's extract) and lignin increase during the vegetative period. In the first year, there was an increase in both constituents. In the second year, the lignin alone increased to the end; the cellulose decreased at the end of June. In the first year, it seemed an absolutely as well as relatively greater amount of cellulose and lignin was produced than in the second year; this, however, requires confirmation. The amount of pentosans in the Schweizer extract was relatively greater in the second than in the first year, but decreased in the lignin more in the second year than in the first; this result is also given with reserve.

N. H. J. M.

Volumetric Estimation of Nitrated Derivatives of Phenols. By LEO SCHWARZ (*Monatsh.*, 1898, **14**, 139—153).—The method originally suggested by Mohr for the estimation of acids by titrating the amount of iodine liberated by them from a mixture of an iodate and an iodide, is applicable to the estimation of the nitrated phenols and some of their derivatives. In order to obtain an accurate result, the phenol must be heated with the mixture of iodate and iodide at 100°, in a closed vessel, for some time. Under these circumstances, it is found that tri- and tetra-nitro-derivatives yield satisfactory results independent of the duration of heating, experiments having been made with picric acid, trinitroresorcinol, trinitro-α-naphthol, 2 : 5 : 6-trinitrothymol, and tetranitrofluorescein. Dinitro-compounds, on the other hand, yield iodine substitution products when the heating is prolonged, and a low result is then obtained (2 : 4-dinitrophenol, 2 : 4-dinitro-α-naphthol, 3 : 5-dinitrocresol, 2 : 6-dinitrothymol, dinitrofluorescein, and 3 : 5-dinitrosalicylic acid). Finally, mononitrophenols so readily yield substitution products that they cannot be estimated in this way; paranitrophenoxyacetic acid, however, gives good results.

A. H.

Application of Alkaline Formalin in Quantitative Analysis. By Ludwig Vanino (*Ber.*, 1898, **31**, 1763—1765. Compare this vol., ii, 461).—Gold and silver may be conveniently estimated by precipitating the metals with an alkaline solution of formaldehyde.

Silver chloride is converted quantitatively into metallic silver by the agency of formaldehyde and caustic soda. In the case of silver bromide and iodide, the decomposition proceeds with greater difficulty, and is not complete.

M. O. F.

Generalisation of Legal's Reaction. By G. Denigès (*Bull. Soc. Chim.*, 1897, [iii], **17**, 381—382. Compare Abstr., 1897, ii, 467).—The author acknowledges the claim of Béla von Bittó (Abstr., 1892, 924) to priority in the study of the nitroprusside reaction for aldehydes, &c., and draws attention to certain points of difference between his own work and that of von Bittó, with whose conclusions he is in general agreement.

N. L.

Analysis of Crude Tartars, &c. (*Zeit. anal. Chem.*, 1898, **37**, 382—384. See this vol., ii, 465).—The chemists at the factory "late Goldenberg, Geromont and Co." have introduced the following modifications into their process. The mixture of lees with hydrochloric acid is diluted with an equal volume of water after the first hour's digestion, and then allowed to remain for a second hour before making up; the evaporated filtrate is treated with acetic acid while hot instead of first cooling: after stirring for 5 minutes, the alcohol is added immediately, thus avoiding the precipitation of slimy substances which would obstinately retain acetic acid. The washing is prolonged until 30 c.c. of the filtrate requires only 2—3 drops of N/5 alkali to render it alkaline, the indicator used in the titration being a sensitive litmus paper of reddish-violet colour. In all other respects, the details of the former method are retained.

M. J. S.

Detection and Separation of Admixed Tartaric, Racemic, and Mesotartaric Acids. By Arnold F. Holleman (*Rec. Trav. Chim.*, 1898, **17**, 69—75). See this vol., i, 515.

Estimation of Succinic Acid in the Presence of Tartaric and Lactic Acids. By Fred. Bordas, Joulin and Sig. de Raczkowski (*J. Pharm.*, 1898, [vi], **7**, 417—418).—The solution containing the three acids is exactly neutralised with N/10 potassium hydroxide, an excess of a concentrated solution of silver nitrate added, and the precipitate removed and washed until the filtrate no longer gives a precipitate with potassium chromate. The precipitate consists of silver succinate, all the silver tartrate having been dissolved by the water. The precipitate is washed into a flask with water, one or two drops of potassium chromate solution added, and N/10 sodium chloride run in until the red colour of the precipitate disappears and the liquid becomes slightly yellow; the solution is finally titrated back with N/10 silver nitrate. J. J. S.

Volumetric Estimation of Glycerophosphates. By H. IMBERT and J. PAGÈS (*J. Pharm.*, 1898, [vi], 7, 378—384).—It is stated that the method adopted by Imbert and Astruc is general and sufficiently accurate. By the use of calcium chloride, phosphates may also be estimated in the presence of glycerophosphates, especially if the amount of phosphate present is more than 5 per cent. of the mixture. Below this limit, the method is not so trustworthy. Borates and silicates must be detected by a special analysis. J. J. S.

Estimation of Rosin and Rosin Oil in Linseed Oil. By LEONARD DE KONINGH (*Chem. News*, 1898, **77**, 287).—McIlhiney (Abstr., 1894, ii, 370) has shown that boiled linseed oil, when treated with bromine, yields no hydrogen bromide, but that a large quantity of this acid is formed when the oil contains rosin or rosin oil. In order to make this a practical process for the assay of linseed oil, the author first takes the bromine-acidity figure of the sample, and if it is fairly high, there is no doubt that rosin, rosin oil, or both are present. Another portion of the sample is now saponified with alcoholic potash and any unsaponifiable matter is extracted by means of light petroleum; if any appreciable quantity is obtained, the bromine-acidity figure is taken, which then will simply represent rosin oil. Rosin oil, as it occurs in England, contains but very little saponifiable matter, but samples from German origin contain much more of the rosin acids, and will, therefore, be only partially recovered by the alkali-petroleum treatment.

Rosin cannot be estimated by isolating the fatty acids from the extracted soap-ley, and subjecting them to the bromine treatment, as, even when free from rosin, they yield an appreciable quantity of hydrogen bromide. If the sample of linseed oil should contain free fatty acids, it will, of course, yield a trace of hydrogen bromide

If rosin should be found, it may to some extent be derived from the use of inferior rosin oil. If the oil contains no mineral matter, the presence of added rosin becomes very doubtful. L. DE K.

Analysis of Theobromine. By MAURICE FRANÇOIS (*J. Pharm.*, 1898, [vi], 7, 521—523).—The following tests are recommended. A solution of theobromine in nitric acid and water yields a precipitate with a 10 per cent. solution of silver nitrate; on warming and then allowing to cool, colourless needles are deposited.

The formation of theobromine tetriodide is another good test. Also treatment with bromine water and subsequent addition of ferrous sulphate and ammonia, when an indigo blue colour is developed; this last reaction is also given by caffeine.

For analysis, the best methods are. 1. Heating in a platinum vessel; no residue should be left. 2. Melting point determination (338—340°). 3. Determination of solubility in alcohol of 95°. The solubility of theobromine at 21° is 0·045 gram in 100 c.c. of alcohol, whereas for caffeine the amount is 0·93 gram in 100 c.c. If theobromine contains 5 per cent. of caffeine, 100 c.c. of alcohol dissolves 0·29 gram of the mixture. J. J. S.

Chemico-legal Detection of Vegetable Poisons. By MICHAEL VON SÉNKOWSKI (*Zeit. anal. Chem.*, 1898, **37**, 359—365).—The author is unable to confirm unconditionally the statement of Kippenberger (Abstr., 1895, ii, 465) that glycerotannic acid effects an universal separation of the vegetable alkaloids from the products of decomposition of animal matter. Solutions of peptone (Witte's) and of colchicine and helleborein behave almost identically with that reagent, giving no precipitate until water is added. Concentrated glycerotannic acid dissolves even albumin. The alkaloid tannates are, however, not completely insoluble in water, and when brought in contact with hide powder the tannic acid is completely removed from them, leaving the alkaloid in solution. With proteids, this is not the case; they remain entirely in the precipitate. An aqueous extract of cadaveric matter, acidified with tartaric acid, is therefore precipitated by a 10 per cent. solution of tannic acid (which must be as free as possible from gallic acid) using as small an excess as possible; about 10—15 c.c. to 100 grams of a substance is generally sufficient. Hide powder is then immediately added in quantity sufficient to render all the tannic acid insoluble, and after a few hours the whole is thrown on a filter. A clear and almost colourless filtrate is obtained, which is ready for extraction with ether or chloroform. Care must be taken to keep the mixture acid during the whole operation, otherwise part of the alkaloid may remain in the precipitate. It is also advisable to shake the filtrate with light petroleum before using the alkaloid solvent, otherwise the alkaloid may be contaminated with traces of fat.

M. J. S.

Estimation of Alkaloids in Tinctures. By JULIUS KATZ (*Arch. Pharm.*, 1898, **236**, 81—100).—By the following methods of estimating the amount of alkaloids in tinctures, &c., the author avoids the application of heat which causes the decomposition of many alkaloids. To 25 c.c. of the tincture containing about 45 per cent. of alcohol, 1 c.c. of a 33 per cent. solution of sodium carbonate is added, and the alkaline solution shaken with 50 c.c. of ether. The ethereal extract is washed with 3 c.c. of water, the alkaline solution extracted twice with successive quantities of 25 c.c. of ether containing 10 per cent. of alcohol, and the extracts washed separately with 1·5 c.c. of water. The mixed ethereal solutions are shaken with 2—3 grams of ignited calcium sulphate, filtered into a flask containing 50 c.c. of water, and then titrated by Partheil's method with centinormal acid, using 3 drops of an alcoholic solution of iodeosin (1 : 250) as indicator. In the case of tinctures containing alkaloids which are not easily soluble in ether, 25 c.c. is extracted with 30 c.c. of a mixture of 3 parts of chloroform with 1 of ether, the extract washed with 3 c.c. of a 30 per cent. solution of sodium chloride, and the process repeated twice, using 15 c.c. of the solvent and 1·5 c.c. of salt solution each time. If necessary, the separation of the chloroform-ether from the aqueous solution may be accelerated by adding 2—3 grams of sodium chloride. The mixed extracts are run into 10—15 c.c. of a 10 per cent. solution of sodium chloride and titrated as before.

Tinctures which contain more than 45 per cent. of alcohol are diluted with water, or when chloroform and ether are to be used, with a 15 per cent. solution of sodium chloride. Preparations containing chlorophyll or fat are shaken with an equal weight of water acidified with a few drops of sulphuric acid and then filtered; the last traces of fat are removed by shaking with light petroleum. The author finds that the alkaloid cannot be completely removed by the above methods from aqueous extracts which contain more than 3 per cent. of the alkaloid, possibly on account of their high content of pectin. 1—1·5 grams of extract is dissolved in 40—50 c.c. of 45 per cent. alcohol, and the alkaloid then estimated as in the case of a tincture. Estimations of aconitine, atropine, hyoscyamine, coniine, emetine, and of the alkaloids in a number of homœopathic essences and extracts are quoted.
E. W. W.

Estimation of Plant-food in Soils. By WALTER MAXWELL (*J. Amer. Chem. Soc.*, 1898, **20**, 107—109).—This is a preliminary note on the best solvents for using in the testing of soils for agricultural purposes. Carbon acids and amido-acids only should be used; mineral acids should be excluded.
L. DE K.

Method of Drying Fæces. By HEINRICH PODA (*Zeit. physiol. Chem.*, 1898, **25**, 355—359).—The chief point in this method, which is described as easy and rapid, consists in performing the desiccating process after the mass has been treated with absolute alcohol.
W. D. H.

The Estimation of Hæmoglobin in Cat's Blood. By FRIEDRICH KRÜGER (*Zeit. physiol. Chem.*, 1898, **25**, 256—257).—The statement made by Abderhalden (this vol., ii, 415) that cat's hæmoglobin is difficult to crystallise is disputed. His quantitative results also are criticised, as no spectrophotometric observations were made.
W. D. H.

General and Physical Chemistry.

Spectra of some of the Elements with a Constant Luminous Discharge in Geissler Tubes. By ALFRED KALÄHNE (*Ann. Phys., Chem.*, 1898, [ii], **65**, 815—848).—The spectra of iodine, bromine, mercury, cadmium, sodium, tin, and lead were examined under a constant discharge from 600 accumulator cells, giving an E. M. F. of 1200 volts. The appearances obtained were qualitatively similar to those which are given by weak, intermittent discharges. The proportionality between light intensity and current strength which Ångström noticed with nitrogen and hydrogen, was not observed with mercury or cadmium vapour. In the case of cadmium, the intensity of the lines increases more rapidly, with mercury less rapidly, than the current strength. With a constant current, the lines in the mercury and cadmium spectra decrease in intensity with increasing pressure. H. C.

Racemic Substances. By FRIEDRICH W. KÜSTER (*Ber.*, 1898, **31**, 1847—1853).—Landolt (*Optische Drehungsvermögen*, 2nd ed.) concludes that racemic (*r*) compounds only exist in the crystalline state; in the liquid state and in solution, they are entirely dissociated into their dextrorotatory (*d*) and lævorotatory (*l*) components. This, however, is not universally true; for instance, 100 parts of water dissolve only 0·684 parts of silver *l*-valerate, but 1·182 of the *r*-salt. Taking the electrolytic dissociation into account, it can be shown that the solution of the *r*-valerate would be supersaturated as regards the *l*-salt, supposing it to be dissociated entirely into its components. The discrepancy can only be explained by supposing that part of the *r*-salt remains in the racemic condition, even after it has gone into solution; this part can be calculated to be at least 20 per cent. of the whole. A similar supposition must be made with regard to barium camphoronate, of which the *d* and *l* varieties are very sparingly soluble, whilst the *r* variety dissolves very readily. To take the case of a liquid, it is possible to calculate, from the known solubility of *d*-coniine (1·80 parts in 100 of water at 19·5°) what would be the solubility of *r*-coniine, assuming the latter liquid to be simply a (*dl*) mixture of *d* and *l* components. The solubility thus calculated is considerably greater than that actually observed (1·93 parts); this could be accounted for by supposing not less than 30 per cent. of the liquid *r*-coniine to exist still in the racemic condition, or about 15 per cent., if it be assumed that the active coniines are also associated each into double molecules. C. F. B.

Action of Ammonium Persulphate on the Silver of Photographic Plates. By AUGUSTE LUMIÈRE, LOUIS LUMIÈRE and ALPHONSE SEYEWETZ (*Compt. rend.*, 1898, **126**, 1639—1642).—The use of a 5 per cent. aqueous solution of ammonium persulphate is recommended for the correction of over-exposed and over-developed photographic plates, this reagent having the advantage over other reducers of preserving the half-tones. It appears that the ammonium persulphate penetrates the gelatin film and dissolves the silver deposited in its lower layers, a soluble double sulphate of silver and ammonium being formed. The latter diffuses through the film and, on reaching the surface, is reduced by the excess of ammonium persulphate with which it there comes in contact, with evolution of oxygen and deposition of metallic silver. This deposition compensates to some extent for the solution of silver taking place in the interior of the film, but since the former process occurs only at the surface, whilst the latter is confined to the deeper parts of the film, it follows that the superficial half-tones are but little affected whereas the deeper and denser deposits are considerably reduced. N. L.

Radiations from Thorium and its Compounds. By Gerhard Carl Schmidt (*Compt. rend.*, 1898, **126**, 1264).—Thorium and its compounds emit radiations analogous to those emitted by uranium and its compounds; they discharge an electrified body whatever the sign of the charge, and the effect is exerted through a thin sheet of aluminium. The nitrate and sulphate are more active than the oxide.

C. H. B.

Electrical Oscillations. By Hugo Kauffman (*Zeit. physikal. Chem.*, 1898, **26**, 719—727).—When the vapours of various chemical compounds are exposed to the influence of electrical oscillations, various results may occur: (1) the vapour may become luminous; (2) it may be crossed by spark discharges, usually of a green colour; (3) it may remain dark, at least until a very high tension is reached. The behaviour in this respect of over 50 compounds was investigated, and, although general deductions cannot be drawn from so few observations, yet some constitutive influences are indicated. Thus, almost all the aromatic amines become luminous, and present more or less similar appearances, whilst the ease with which luminosity occurs appears to be in part dependent on the basic character of the amine, as compounds which, by substitution, have lost their basic nature (for example, nitraniline or tribromaniline) are no longer rendered luminous. This rule, however, cannot be extended to cyclic compounds containing nitrogen. Amongst hydrocarbons, the aliphatic compounds and the simple benzene compounds remain dark until a very high tension is reached; but most of the hydrocarbons containing two or more benzene rings readily become luminous. In all cases, it was observed that, during luminosity, the vapour acted as a conductor.

L. M. J.

Mercury-zinc and Mercury-cadmium Cells as Standards. By Wilhelm Jaeger and K. Kahle (*Ann. phys. Chem.*, 1898, [ii], **65**, 926—942).—A comparison of a series of Clark standard cells with cells of the Weston type has been made during a period of over twelve months, in order to test the constancy of these cells. The mean of the results obtained is given below.

Date	Clark 0°. / Cadm. 20°.	Clark 15°. / Cadm. 20°.	Clark 0°. – Clark 15°.	
March, 1896	1·4227	1·4066	0·0164	int. volt.
Jan., 1897	1·42277	1·40676	0·01631	,,
Nov., 1897	1·4228	1·40660	0·01650	,,
Mean	1·42277	1·40663	0·01642.	

H. C.

Efficiency of an Electrolytic Cell. By FERDINAND HURTER and B. ZAHORSKI (*J. Soc. Chem. Ind.*, 1897, **16**, 97—107).—A formula which expresses the efficiency of an electrolytic cell, or that fraction of the energy consumed by the cell which is converted into the desired potential chemical energy, is ae/V. Here e is the so-called back E. M. F. corresponding to the products which are desired, and V the actual E. M. F. measured at the terminals of the cell. The factor a is the fraction of the electrochemical equivalent of the desired substance actually obtained per ampère. Theoretically, for every ampère of current, one electrochemical equivalent should be obtained, and this theoretical yield is easily approached in all cases where the separated ions are deposited as solids or removed as gases. But where the products of electrolysis remain in solution, the newly-formed products take part in the conduction of the current, some of which therefore is wasted. To make a satisfactory calculation of the exact value of the current efficiency, it is therefore necessary to know how the current divides between several electrolytes. This, as Hittorf has pointed out, can be found by migration experiments, and current efficiency depends chiefly on the phenomena of migration, or, what is practically the same thing, the conductivity of the solutions. As the authors show, a limiting value of the current efficiency can, therefore, be calculated, but in most cases this is all, as in complicated processes we know but little of the real values of the E. M. F. of polarisation. H. C.

Chemical Theory of the Lead Accumulator. By F. DOLEZALEK (*Ann. phys. Chem.*, 1898, [ii], **65**, 894—920).—The simplest theory of the changes occurring in the lead accumulator is expressed by the equation $PbO_2 + Pb + 2H_2SO_4 \rightleftarrows 2PbSO_4 + 2H_2O$. On charging, the reaction occurs from left to right, on discharging, from right to left. This process would be a fully reversible one, but many of the changes which occur in the accumulator when at work are not apparently in keeping with this simple view of its action; this is more especially the case with the behaviour on charging and discharging, as the E. M. F. is found to be slightly higher during the first than during the second operation, thus causing a considerable loss of energy. The author traces this loss to the changes which take place in the concentration of the acid, and consequent diffusion and convection, and also production of concentration currents in the cell. Taking these changes into account, the above theory of a fully reversible reaction in the sense given is fully satisfactory. H. C.

New Electrolytic Diaphragm. By HEINRICH PAULI and LUDWIG PINCUSSOHN (*Chem. Zeit.*, 1897, **21**, 1048—1049).—The improved cell recommended by the authors is made much shorter and wider than the ordinary commercial porous pot. At its upper end, it is strengthened by a flange containing four holes, through which two wires are passed, and in this manner the cell is suspended within the outer vessel, such as a flat crystallising pan. As the electrodes are not curved, but straight and parallel, it is easier to keep up a uniform current density.

L. DE K.

Accuracy of the Values of Dissociation Determined by the Electrical Conductivity Method. By ARTHUR A. NOYES (*Zeit. physikal. Chem.*, 1898, **26**, 699—710, and *J. Amer. Chem. Soc.*, 1898, **20**, 517—528).—Van Laar considers that the conductivity method does not give accurate values for the dissociation (this vol., ii., 158); the author is of a contrary opinion, and shows that, in some particulars, the expressions deduced by van Laar for the heat of dissolution are inaccurate, and deduces formulæ based upon both Ostwald's and van't Hoff's dilution laws. The values, as calculated by these expressions, especially in the case of the second, agree well with the experimentally found values in the cases of those compounds where van Laar had found that discrepancies occur between the determinations and the values deduced by his formula. The fact that the inversion velocities of sugar by hydrogen chloride differ in water and in aqueous alcohol (Cohen, this vol., ii, 154), although the dissociation as determined by the conductivity is equal in the two solvents, does not disprove the availability of the conductivity method, as the alcohol may have a catalytic retarding influence on the reaction itself, whilst, further, the experiments of Lowenherz actually indicate a lowering of the dissociation in aqueous solutions on the addition of alcohol (Abstr., 1896, ii, 587). The conductivity dissociation values for potassium chloride in from N/100 to N/10 aqueous solutions are in very close accord with those determined cryoscopically by Jones, Loomis, Abegg, and Raoult, whilst for sodium chlorides the values do not differ more from the mean of the cryoscopic results than do the latter among themselves. The author, therefore, considers that the conductivity method does actually yield the true dissociation, and further points out that, even if van Laar's contention were supported, his explanation fails, inasmuch as it necessitates that the dissociation values should alter with the current strength, which is not the case.

L. M. J.

Electrical Conductivity of Potassium Permanganate Solutions. By GEORG BREDIG (*Compt. rend.*, 1898, **126**, 1269).—Measures of the electrical conductivity of dilute solutions of potassium permanganate have been made by the author (*Zeit. physikal. Chem.*, 1893, **12**, 233, and 1894, **13**, 217, and by Franke and Loven, *ibid.*, 1895, **16**, 475, and 1896, **7**, 376. Compare Legrand, this vol., ii, 496).

C. H. B.

Conductivity of Aqueous Solutions of Praseodymium and Neodymium Sulphates. By HARRY C. JONES and H. M. REESE (*Amer. Chem. J.*, 1898, **20**, 606—607).—The following table gives the conductivity of aqueous solutions of the salts for various concentrations; v denotes the number of litres of solution which contain a gram molecule of the salt, and μ_v the corresponding molecular conductivity.

Praseodymium sulphate.		Neodymium sulphate.	
v.	μ_v	v.	μ_v
14·71	98·33	25·33	115·03
29·42	117·43	50·65	137·65
58·84	141·42	101·31	166·35
117·68	169·47	202·62	197·91
294·2	217·83	506·5	255·43
588·4	262·65	1013·0	303·45
1176·8	317·10	2026·0	366·0
1471·0	331·43	2532·6	382·9
2942·0	403·37	5065·2	462·5
5884·0	482·61		

W. A. D.

Determination of Transference Ratios by Electrolysis of Dilute Salt Solutions. By Willi Bein (*Zeit. physikal. Chem.*, 1898, **27**, 1—54).—The work of previous observers is discussed at considerable length with especial reference to the influence of diffusion on the values obtained. The method used by the author is the general one of the analysis of the anodic, mean, and cathodic liquids, but various forms of apparatus were employed according to the dilution of the electrolyte and the temperature required; all these are described, and numerous figures are given. For sodium and hydrogen chlorides, the values were found to be almost independent of the concentration, but to vary with the temperature, the transference numbers for the anions being given by the expressions: HCl, $n_t = 0·157 + 0·0009t$; NaCl, $n_t = 0·622—0·00074t$. For potassium chloride, the values $n_{11} = 0·503$ and $n_{76} = 0·513$ were obtained, and appeared to be independent of concentration, at least between the limits of N/5 and N/100. For lithium chloride, the values $n_{20} = 0·624$ and $n_{97} = 0·621$ were obtained in N/100 solutions, and $n_{25} = 0·672$; $n_{96} = 0·610$ for N/5 to N/20 solutions. For ammonium chloride, rubidium chloride, cæsium chloride, and thallium chloride, the values 0·507, 0·515, 0·508, 0·516 were respectively obtained at about 20°. Calcium chloride gave results similar to those obtained for lithium chloride, the transference ratios changing but slightly with dilution at high temperatures: thus $n_{22} = 0·553$, $n_{96} = 0·530$ for N/100 solution, and $n_{22} = 0·608$ for n_4 solution. For barium chloride, $n_{10} = 0·559$ and $n_{97} = 0·515$ in solutions containing 0·04 per cent. chlorine, and $n_{12} = 0·583$, $n_{97} = 0·554$ in solutions containing 0·78 per cent. chlorine. For cadmium chloride, $n_{22} = 0·568$ and $n_{96} = 0·473$ in solutions with 0·2 per cent. chlorine, but at higher concentrations the temperature change was much less. Silver acetate gave the values $n_{24} = 0·413$ and $n_{96} = 0·439$, which, however, do not agree with the results of Nernst and Hittorf. Sulphuric acid gave numbers in accord with the expression $n_t = 0·160 + 0·0015t$, and these also differ from Hittorf's values. For copper sulphate, the values vary slightly with concentration and temperature, and apparently give a maximum of 0·632 at 15°, for silver nitrate, $n_{76} = 0·517$ changing but slightly with temperature. The remaining determinations were all made at temperatures of about 20—25° with the following results.

Salt.	*n*.	Salt.	*n*.
Strontium chloride	0·560	Thallium sulphate	0·528
Magnesium chloride	0·615	Magnesium sulphate	0·541
Manganese chloride	0·613	Sodium carbonate	0·600
Cupric chloride	0·595	Potassium carbonate	0·435
Cobalt chloride	0·585	Sodium hydroxide	0·799
Sodium bromide	0·625	Ammonium hydroxide	0·562
Potassium iodide	0·505	Calcium hydroxide	0·786
Hydrogen nitrate	0·172	Potassium permanganate	0·559
Sodium nitrate	0·629	Hydrogen succinate	0·239
Hydrogen oxalate	0·214		

Some determinations were also made in the case of solutions of concentration from 3N to 4N. The values obtained differ very considerably, however, from those at low concentrations, and exhibit a much more marked temperature change; for example, HCl (13·94 per cent. Cl), $n_{97} = 0·393$; NaCl (12 per cent. Cl), $n_{20} = 0·677$; $CdCl_2$ (13·8 to 13·6 per cent. Cl), $n_{24} = 0·657$, $n_{97} = 0·960$; $CaCl_2$ (14 per cent. Cl), $n_{25} = 0·718$; $CoCl_2$ (9·7 per cent. Cl), $n_{25} = 0·737$, $n_{97} = 0·79$. L. M. J.

Dissociation of Water. By R. A. LEHFELDT (*Zeit. physikal. Chem.*, 1898, **27**, 94).—Luther has calculated recently (this vol., ii, 422) that, at 20°, the concentration of free hydrogen in water vapour is $10·10^{-27}$ gram-molecules per litre. The author considers such determinations to be of no value whatever, and points out that, assuming the mass of the molecule of hydrogen to be $1·6 \times 10^{-24}$ (Nernst), Luther finds that 1 molecule of hydrogen is present in 80 litres. L. M. J.

Relation between Solubility and the Heat of Formation of Electrolytes. By GUIDO BODLÄNDER. (*Zeit. physikal. Chem.*, 1898, **27**, 55—74).—The electromotive force required to separate the ions of a salt in a saturated solution is given by the equation $E_s = E_a + E_k - 0·058 \log p^{\frac{1}{n_a}+\frac{1}{n_k}}$ where n_a and n_k are the valencies of the ions, E_a, E_k are the E.M.F. necessary to separate the anion and cation respectively in normal solutions, and p is the solubility in equivalents. The values for E_a and E_k have been given by Nernst and Neumann (Abstr., 1894, ii, 373; 1897, ii, 394), so that from E_s the value of p can be derived, and *vice versâ*. Since the heat of formation of the compound is approximately proportional to E_s and is given by the equation $Q = 230E_s$, the relation between p and Q is obtained. The first set of compounds investigated were the iodides, and the calculated values for the solubility are compared with the experimental numbers. In this set, the agreement, although far from exact, was fairly satisfactory, but for the bromides and chlorides the calculated numbers can only be said to be of the same order of magnitude as the actual values. For the fluorides, the value of E_a is not known, but is calculated from the solubility of silver fluoride; from this, the solubilities of other fluorides are derived with fair agreement with experimental numbers. For the sulphides, the actual solubilities were not calculated, but the order must be that of the differences $E_k - E_s$, and the order so obtained agrees, with few exceptions, with the known chemical properties of the sulphides. For the hydroxides, the value of E_a is obtained from the solubility of lead hydroxide, and from this, the values for the solubility of other hydroxides; here satisfactory results were obtained, but this was not the case with the sulphates. Assuming the formula to be accurate, the heat of formation is calculated from the solubility in the case of some iodides, and from the difference between the value thus obtained and the value found, the author deduces the temperature coefficient of the E.M.F., but it is doubtful whether any value really attaches to these numbers. It is seen from the expression given that the following law holds in the case of slightly soluble salts; for salts of different acids with the same metal, the solubility increases with the tendency of the acid radicle to pass from the electrically neutral to the ion state; a similar law holds for salts of different metals with the same acid, and examples are adduced. In the case of two salts with the same cation, the solubility of the first must be greater or less than that of the second according as $(\mathrm{E}_a - E_a')$ is greater or less than $(E_s - E_s')$. In the case of bromides and chlorides, therefore, where $(E_s - E_s') > 85{\cdot}1/230 (= E_a - E_a')$ the bromide is the more soluble, and this is found to be in accord with the facts, a similar application to the salts of silver and sodium also giving valid results. L. M. J.

Law of Thermal Constant. By DONATO TOMMASI (*Bull. Soc. Chim.*, 1897, [iii], 17, 438—440).—In his work on the themochemistry of mercury salts (Abstr., 1896, ii, 648), Varet finds that these salts conform to the law that the replacement of one metal by another in solutions of their salts always gives rise, in the case of any two metals, to the same heat change, no matter what acid radicle is present. This law Varet attributes to Andrews, and Favre and Silbermann, but the author claims to have been the first to enunciate it in 1882. H. C.

Cryoscopic Measurements. By A. PONSOT (*Bull. Soc. Chim.*, 1897, [iii], 17, 395—405).—Four series of cryoscopic determinations were made with dilute sugar solutions, every precaution being taken to eliminate error. The molecular reductions found were 19·01, 18·50, 18·725, and 18·97. The value, calculated by the van't Hoff formula is 18·77. H. C.

Transition Temperature of Sodium Sulphate. A New Fixed Point in Thermometry. By THEODORE W. RICHARDS and JESSE BRIGGS CHURCHILL (*Zeit. physikal. Chem.*, 1898, 26, 690—698).—The transition temperature of the change $Na_2SO_4,10H_2O \rightarrow Na_2SO_4 + 10H_2O$ is considered to be a very suitable fixed temperature for thermometry, and the following are the advantages claimed by the authors. The salt can be readily obtained in a state of sufficient purity, as after two crystallisations further purification has practically no effect on the transition temperature, which is also unaffected by pressure, whilst, further, the temperature of an outer bath has very little influence if the temperature of the above direct action is taken, namely, that of the melting of the hydrate. Very careful determinations gave the temperature as 32·484°, and it was found that no extraordinary care is requisite in order to get values correct to 0·01°. This temperature is 32·379° on the hydrogen scale, and is near the point of maximum difference between the two scales. The authors also consider it probable that other transition points will be found suitable for thermometric fixed temperatures. L. M. J.

Tables for the Reduction of Boiling Points to Normal Pressure. By PAUL FUCHS (*Zeit. angw. Chem.*, 1898, 869—871).—Useful tables are given of the boiling points of some liquids at pressures varying from 710—780 mm ; the list includes acetone, alcohol, aniline, benzene, methylic alcohol, bromobenzene, chlorobenzene, and metaxylene. L. DE K.

Vapour Pressure Measurements. II. By GEORG W. A. KAHLBAUM (*Zeit. physikal. Chem.*, 1898, **26**, 577—658. See Abstr., 1894, ii, 131).—[With P. SCHROETER and C. G. VON WIRKNER].—The authors first show that when a liquid is boiled under reduced pressure, the actual pressure in the boiling flask is equal to that measured at the end of the condenser.

[With EMIL TOENNIES and C. G. VON WIRKNER.]—The vapour tension determinations by the dynamical method were subjected to severe tests, measurements by different observers at different times being compared ; separate curves were also constructed for the same set of determinations, in order to see whether errors arise from the method of plotting and interpolation. In all cases, the concordance is very complete, so that the dynamical determinations are trustworthy, a result also confirmed by the fact that the differences between the boiling points of benzene, toluene, and water at pressures varying from 35 mm. to 760 mm. exhibit no *irregular* variations, but change continuously.

[With C. G. VON WIRKNER.]—The series of fatty acids were first investigated, and the boiling points compared at a large number of pressures varying from 10 mm. to 760 mm. The values were compared with those calculated from the boiling points of water and of propionic acid by Dühring's law. In all cases, the determinations differ from the calculated values, but the differences are less when the values are deduced from propionic acid than when they are obtained from water. Dühring's law, therefore, although of use in such cases, cannot be regarded as an absolute natural law. The differences between the boiling points of the whole series (C_1 to C_{10}) at the various pressures are compared ; in the cases of formic and acetic acids, and of nonoic and decoic acids, the difference is independent of pressure, so that the boiling point curves are parallel ; the curves of acetic acid and propionic acid, however, diverge with falling pressure, but in all the other cases the curves approach as the pressure falls. A number of benzene derivatives containing a phenyl group were next examined, and the determinations agree well with those of Ramsay and Young, and other observers, where comparable data are available. The boiling points at 760 mm. ascend in the following order. Benzene, bromobenzene, benzaldehyde, phenol, aniline, benzonitrile, benzylic alcohol, nitrobenzene, benzoic acid ; but at 6 mm. the order becomes benzene, bromobenzene, benzaldehyde, benzonitrile, aniline, phenol, nitrobenzene, benzylic alcohol, benzoic acid ; so that the boiling point curves intersect in the cases of the following pairs, benzonitrile–aniline, benzonitrile–phenol, aniline–phenol, benzylic alcohol–nitrobenzene. The only previously known case of the intersection of vapour pressure curves was that of benzene–ethylic alcohol.

[With C. WICHROWSKI and THEODOR TESSE.]—The vapour pressure determinations of aniline, and its methyl, ethyl, dimethyl, and diethyl derivatives were made at pressures varying from 5 mm. to 760 mm. The boiling points of aniline and dimethylaniline approach with falling pressure, as do those of methylaniline and ethylaniline, whilst those of methylaniline and dimethylaniline diverge, so that the boiling point curves for aniline and methylaniline, and for dimethylaniline and ethylaniline are approximately parallel.

[With THEODOR TESSE.]—Schröder has formulated the rule that the substitution of the groups $-CO\cdot CH_3$, $-COOCH_3$, and $-COCl$ for hydrogen lead to equal changes of the boiling point. The boiling points were, therefore, determined between 1 mm. and 760 mm. in the cases of acetophenone, benzoic chloride, and methylic benzoate. Schröder's rule is not found to be valid, as, although the difference between the boiling points of the two latter compounds at 760 mm. is only 0·4°, yet at 10 mm. it is 3·5°, when the difference between those of the two first compounds is 5·2°.

[With EMIL TOENNIES.]—A number of position isomerides were next investigated, chiefly toluene derivatives, namely, ortho-, meta-, and para-cresol; ortho-, meta-, and para-toluidine; ortho- and para-dimethyltoluidine; ortho- and para-nitrotoluene. In the case of the cresols, the para-compound has throughout the whole range of pressure a boiling point about 0·5° higher than that of the meta-compound, and 11·2° higher than that of the ortho-compound. A similar constant difference in the boiling points occurs in the case of the toluidines, so that for each of these sets of compounds Dalton's law holds. This is not the case, however, in the dimethyltoluidines, nor in the nitrotoluenes, and for these compounds there is a much greater difference in the actual boiling points, so that the law probably only holds for a set of isomerides the boiling points of which are sufficiently near.

[With KURT ARNDT.]—Trimethylene bromide and propylene bromide exhibit a difference of boiling point which increases with pressure, and the same obtains for the ortho- and meta-chloranilines. The boiling point curves of chloro- and bromo-naphthalenes approximate closely at low pressures, so that, whereas the difference in the boiling points at 760 mm. is about 22°, at 1·5 mm. it is only 8°.

The author discusses the bearing of the determinations on the generally accepted relationships between constitution and boiling point, and points out that these can have no real significance, as different relations are found when the boiling points are taken at pressures other than 760 mm. Comparisons in the benzene series indicate that throughout all pressures, substitution produces a greater effect in a benzene group than in a toluene group, and that the boiling point pressure curves are flatter for simple compounds than for complex, although a few exceptions occur; this the author considers to be due to greater cohesion among the simpler molecules. A comparison of the curves for a large number of compounds shows that, in general, those of the fatty compounds are flatter than those of aromatic compounds of approximately equal boiling points, and that, with a solitary exception, no curve of a fatty compound is parallel to that of any aromatic compound, although parallelism frequently occurs between two fatty compounds or two aromatic compounds. The presence of the hydroxyl group appears also to have an influence in causing flatness of a curve, but, on the whole, the author allows that little can be deduced, in the positive sense, from the great accumulation of data.

[With Kurt Arndt.]—Comparisons were made between the decrease of the boiling point between 760 mm. and 10 mm. on the one hand, and the molecular dispersion, as measured by Lorenz's formula, on the other. For this purpose, the latter constant had to be determined for some of the compounds, chiefly aniline derivatives. In a very large number of cases, it is evident that an increase in the one constant is accompanied by an increase in the other, the number in which this is the case being too great to be ascribed to mere coincidence, especially when the comparison is made between allied compounds with different dispersions, or between compounds of different boiling points but equal boiling point change, and also equal dispersion. Nevertheless, many exceptions occur, the most noteworthy being the series of fatty acids, where, although the boiling point decrease is practically constant, yet the molecular dispersion continuously increases. In this case, however, the actual dispersion is approximately constant, and although the author offers no explanation, he considers that a real connection between the two constants is indicated. L. M. J.

Thermochemical Data for Ethylmalonic Acid and its Isomerides, Glutaric and Methylsuccinic Acids. By Gustave Massol (*Compt. rend.*, 1898, **126**, 1354—1355).—Ethylmalonic acid melts at 111·5° and dissolves in water with absorption of heat (−2·96 Cal.). The heats of neutralisation for the first and second molecules of potash are +14·08 and +13·80 Cal. respectively, both acid and base being in solution. The normal potassium salt dissolves in water with development of 4·45 Cal., and its heat of formation from the solid acid and base is +48·25 Cal.; comparison of the latter figure with the corresponding numbers for methylsuccinic acid, +45·18 Cal., and glutaric acid, +44·23 Cal., shows that the heat of formation of the normal salts of the three isomeric acids decreases progressively with increase of the distance between the carboxyl groups. A similar relation is observed in the case of the three phthalic acids. N. L.

Heat of Neutralisation of Phenylphosphoric Acid. By G. Belugou (*Compt. rend.*, 1898, **126**, 1575—1576).—Phenylphosphoric acid is prepared by the action of phosphoric anhydride on phenol, the diphenylphosphoric acid that is formed at the same time being removed by washing with ether, and the excess of phosphoric acid by fractionally precipitating the aqueous solution with lead acetate. The heat of neutralisation by sodium hydroxide is +14·6 Cal. for the first equivalent, and +13·8 Cal. for the second equivalent, a result similar to those obtained by Cavalier with methyl- and ethyl-phosphoric acids, and by the author with ethylphosphoric acid and glycerophosphoric acid. Phenylphosphoric acid also behaves in the same way as the others with methyl-orange and phenolphthalein.

When phosphoric anhydride acts on an alcohol or a phenol, solid metaphosphoric acid and a syrupy liquid are obtained. If some of the liquid is dissolved in water, the quantity of alkali necessary to make it neutral to methyl-orange is higher than that required to pass from neutrality toward methyl-orange to neutrality toward phenolphthalein. The syrupy liquid contains no metaphosphoric acid, and hence the effect just described must be due to the di-substituted phosphoric acid that is present. C. H. B.

Pyridine Bases. By Marcel Delépine (*Compt. rend.*, 1898, **126**, 1794—1797).—The following thermochemical data were determined.

	Pyridine.		Piperidine.	
Specific heat (between 16° and 96—98°) ...	33·5	Cal.	44·1	Cal.
Heat of volatilisation........................	8·57	„	7·9	„
Heat of combustion at constant volume (liquid)....................................	664·68	„	825·21	„
Heat of combustion at constant pressure (liquid)...	665·1	„	826·5	„
Heat of combustion at constant pressure (gas)...	673·7	„	834·4	„
Heat of formation (liquid)......................	−21·1	„	+24·5	„
„ „ (gas)	−29·7	„	+16·6	„

	Chloropiperidine.	Dipiperideine.	δ-Amido-valeraldehyde.
Heat of combustion at constant volume ...	789·6 Cal.	2 × 766·37 Cal.	805·55 Cal.
Heat of combustion at constant pressure...	790·6 „	2 × 767·4 „	806·55 „
Heat of formation ...	+30·8 „	+2 × 14·6 „	+44·45 „

(1) $C_5H_{10}NH$ liq. + Cl_2 gas = $C_5H_{10}NCl$ liq. + HCl gas + 28·3 Cal.
(2) $C_5H_{10}NH$ diss. + $HClO$ diss. = $C_5H_{10}NCl$ liq. + H_2O liq. + 37·2 Cal.
(3) $2C_5H_{11}NO$ cryst. = $(C_5H_9N)_2$ cryst. + $2H_2O$ solid + 2 × 40·5 Cal.
(4) C_5H_5N liq. + $3H_2$ gas = $C_5H_{11}N$ liq. + 3 × 15·2 Cal.
(5) C_5H_5N liq. + $2H_2$ gas = $\frac{1}{2}(C_5H_9N)_2$ solid + 2 × 17·8 Cal.
(6) $C_5H_{11}N$ diss. + H_2O_2 liq. = $C_5H_{11}NO$ diss. + H_2O liq. + 35·2 Cal. + D.

D being the heat of dissolution of δ-amidovaleraldehyde.

The value 28·3 Cal. given by equation (1) is in fair accordance with the mean value for the heat of substitution of chlorine in organic compounds. Equation (2) explains the fact that piperidine displaces the alkalis from hypochlorites, the latter being formed from hypochlorous acid with the evolution of at most 10 Cal. From the value given by equation (3) should be deducted the unknown heat of polymerisation of $2C_5H_9N$ into $(C_5H_9N)_2$. Supposing this to be equal to the heat of polymerisation of amylene into diamylene (11·8 Cal.), there still remains a large development of heat in equation (3) analogous to that noticed in the quinoline series.

The chloropiperidine employed in these experiments was obtained by the action of concentrated alkali hypochlorite solution on piperidine; it had a sp. gr. = 1·0667 at 0°/4° and 1·0517 at 17°/4°, and boiled at 58° under 39 mm. pressure and 55° under 30 mm. pressure. By the action of sodium hypobromite on piperidine, bromopiperidine is obtained, in theoretical quantity, as a heavy, yellow oil of powerful odour. It is much more unstable than the chloro-derivative, and deflagrates spontaneously on keeping; hence it may, perhaps, be regarded as an alkylamide derived from hypobromous acid and not as a simple bromine substitution derivative. N. L.

The Differential Areometer as Areo-Pyknometer for Determining the Sp. Gr. of Powders. By Paul Fuchs (*Zeit. angw. Chem.*, 1898, 623—625).—This is a patented instrument resembling the ordinary hydrometer, but so arranged that the bottom of the bulb is fitted with an inverted stoppered tube resembling a weighing tube, which can be removed at pleasure. In water, the instrument will sink to the zero division, which is at the bottom of the stem.

The stoppered tube has a mark representing 2 c.c., and must be filled up to that mark with the finely powdered substance such as cement, this being gently pressed in by means of a metallic disc attached to a rod. If the instrument now sinks down to, say, 1·8, this will be the specific gravity of the substance. The whole operation takes about 5 minutes, and the results are technically accurate. L. de K.

Tables for the Correction of Errors caused by Variation in Temperature when using the "Procentareometer." By Paul Fuchs (*Zeit. angw. Chem.*, 1898, 745—755).—These are tables very useful to those who employ "Gustav Müller's areometer" for estimating the percentage of nitric, sulphuric, and hydrochloric acids, and the strength of ammonia. L. de K.

Temperature-Correction Tables for Specific Gravity Determinations. By Paul Fuchs (*Zeit angw. Chem.*, 1898, 909—914).—The author (compare preceding abstract) gives similar specific gravity tables for ethylic acetate, acetone, ether, ethylbenzene, formic acid, amylic acetate, aniline, benzene, chloroform, glycerol, methylic alcohol, nitrobenzene, petroleum, turpentine, toluene, xylene, solutions of potassium chloride and nitrate, sodium chloride, nitrate, and sulphate, ammonium chloride and carbonate, and calcium chloride. L. de K.

Eutropic Series of the Calcium Group. By A. Eppler (*Zeit. Kryst. Min.*, 1898, **30**, 118—175).—The term catameric eutropy, or, shortly, eutropy, has been introduced by G. Linck (*Zeit. physikal. Chem.*, 1896, **19**, 193) for those special cases of isomorphism in which the geometrical and physical characters of members of a series regularly increase or decrease with increase of atomic weight of the varying element, as, for example, in Tutton's potassium, rubidium, and cæsium compounds. In a later paper (*Zeit. Kryst. Min.*, 1896, **26**, 281), Linck states that the quotients of the crystal volume by the molecular volume of the different members of such a series are in the ratio of simple rational numbers. The first relation has been partly tested by Ortloff (Abstr., 1896, ii, 355), and the present author finds that both hold good in the calcium-strontium-barium group, with, however, one or two exceptions, as in the anhydrous sulphates, anhydrite, celestite, and barytes.

Numerous data concerning the crystallised compounds of calcium, strontium, and barium are brought together and compared, and several new geometrical, optical, and density determinations are given. For cubic crystals, the crystal volume becomes unity, and the above quotient is inversely proportional to the molecular volume. In the cubic oxides, fluorides, chlorides, and nitrates of calcium, strontium, and barium, the ratios are 11 : 15 : 19, 14 : 17 : 20, 18 : 19 : 20, 20 : 21 : 22 respectively, thus decreasing with the increase in the total molecular weight. Lead compounds, although often isomorphous with those of calcium, &c., do not belong to the same eutropic series, since the physical constants sometimes fall between those of calcium and strontium, or before or after those of the corresponding barium salt. L. J. S.

Dissociation of Hydrogen Selenide. By H. PÉLABON (*Zeit. physikal. Chem.*, 1898, **26**, 659—689).—The main results given in this paper have already appeared (Abstr., 1896, ii, 96 ; 1897, ii, 251).

A Diffusion Apparatus. By MAX A. SIEGFRIED (*Ber.*, 1898, **31**, 1825—1826).—This consists of a cylindrical glass ring and two cylindrical glass jars, with their axes horizontal. The two rims of the jars and both rims of the ring are welted and ground, and by means of screw clamps attached to metal collars the ground glass surfaces can be pressed together, a piece of parchment paper being first placed at each junction, and made water-tight by means of indiarubber rings or washers. The whole thus consists of a closed cylinder, lying horizontally, and divided into three compartments by diaphragms of parchment paper. The central vessel contains the liquid to be dialysed ; this is stirred by a stirrer which passes through a tubulus on the top of the vessel, and is driven by a small turbine. The two end vessels have each two tubuli, one on the top, the other at the side ; into one vessel, through the top tubulus, flows the waste water from the turbine ; it passes out at the side tubulus, and along glass and indiarubber tubing to the second vessel, which it enters through the side tubulus, and leaves through a glass tube inserted in the top tubulus. The apparatus is manufactured by Franz Hugershoff of Leipsic in three sizes ; in the largest size, the central vessel has a capacity of about 2½ litres. C. F. B.

Solid Solutions of Benzene in Phenol. By GIUSEPPE BRUNI (*Gazzetta*, 1898, **28**, i, 249—258).—Beckmann pointed out (Abstr., 1897, ii, 362) that in cryoscopic determinations in which a solid solution of the solvent and dissolved substances separates, the molecular weight of the dissolved substance can be correctly ascertained from the equation $M_c = M(1 - a)$; M_c is the corrected molecular weight, M the molecular weight deduced from the freezing point, and a the coefficient of distribution of the dissolved substance between the solid and liquid solutions. Cryoscopic determinations with solutions of phenol in benzene as solvent, in which the concentration c increases from 1·2 to 7·9, give values for M increasing from 153—188, whilst the values of M_c increase from 100 to 148; the latter values are comparable in magnitude with the values of M for phenol obtained by the boiling point method in benzene solution, and by the cryoscopic method in paraxylene solution. Bodländer (Abstr., 1897, ii, 133) noted that the lack of uniformity amongst Garelli's numbers (Abstr., 1897, i, 26) is possibly due to a difference of molecular weight of the material dissolved in the two solvents. The author agrees with this view, but considers that Bodländer's method of calculation is faulty.

Solutions of benzene in phenol as the solvent are also cryoscopically abnormal; as c increases from 0·20 to 4·08, M increases from 87·7 to 91·3. Experiments made by Bijlert's method, using benzil as the normal third substance, showed that solid solutions of benzene in phenol were formed, the value of a being 0·24 to 0·33 where a is the coefficient of distribution $a = C_s/C_m$; C_m is the mean of the initial and final concentrations of benzene in the liquid solution, and C_s is the corresponding concentration in the solid solution. The variation in the value of a is attributable to experimental error.

W. J. P.

Solid Solutions of Pyridine and Piperidine in Benzene. By Giuseppe Bruni (*Gazzetta*, 1898, **28**, i, 259—268).—The molecular weights of pyridine and piperidine determined in benzene solution by the cryoscopic method are always greater than the normal, but diminish as the concentration increases to $c =$ about 1, and after that increase as c increases; the values obtained agree on the whole with those obtained by Paternò. Applying Bijlert's method to solutions of piperidine in benzene, benzil being the third substance as before (compare preceding abstract), it was found that solid solutions of the base in the hydrocarbon were formed; the values of a, as the concentration increased, first fell and then rose in much the same way as the molecular weights. Using the Beckmann correction formula, values of M_c varying from 81·7 to 84·8 were obtained; these values are sufficiently close to the normal value of 85. W. J. P.

Solid Solutions of Open Chain Compounds. By Giuseppe Bruni (*Gazzetta*, 1898, **28**, i, 277—283).—Although solutions of closed chain compounds in closed chain solvents, namely, dihydronaphthalene in naphthalene, tetrahydrodiphenyl in diphenyl, and maleic anhydride in succinic anhydride, yield solid solutions, the same kind of behaviour is not observed amongst open chain compounds; oleic and butyric acids show normal cryoscopic behaviour, using stearic and crotonic acids respectively as solvents. This, as Garelli has remarked (Abstr., 1895, ii, 206), is probably due to the alteration of molecular symmetry being greater amongst open than amongst closed chain compounds.

Examples of solid solutions amongst open chain compounds must be sought amongst substances of similar molecular configuration. Trichloracetamide and tribromacetamide form solid solutions (Küster, Abstr., 1892, 396), so also do carbon tetrachloride and carbon tetrabromide (Rothmund, Abstr., 1898, i, 158).

Solutions of chloroform or iodoform in bromoform do not deposit the pure solvent on cooling, the value of M being approximately 600 instead of 394 for solutions of iodoform in bromoform in which c varies from 0·22 to 3·49. Using Bijlert's method, with diphenyl as the third substance, the distribution coefficient a is found to be 0·35—0·37; on correcting by Beckmann's formula, $M_c = M\ (1 - a)$, the values of $M_c =$ 384 to 392 are obtained.

Similarly, solid solutions are deposited on cooling solutions of ethylenic di-iodide or dichloride in ethylenic dibromide. The molecular weights of the dissolved substances are found as 430—443 or 121—132 respectively, instead of having the normal values of 280 or 99.

W. J. P.

Solubility of Carvoxime. By HEINRICH GOLDSCHMIDT and HERMON C. COOPER (*Zeit. physikal. Chem.*, 1898, **26**, 711—718).—Van't Hoff had suggested that two active modifications which are equally soluble in ordinary solvents might be found to have different solubilities in a solvent which is itself optically active, but experiments by Tolloczko (Abstr., 1896, ii, 636) indicated that this was not the case. The authors therefore further investigated the question, and determined the solubility of dextro- and lævo-carvoxime in dextrolimonene. The + compound was prepared from + carvol and the − compound from + limonene nitrosylchloride; both melted at 72°, and gave rotations of +116·1° and −116·3° respectively. No difference of solubility in the +limonene could be detected. The solubility of the *solid* inactive carvoxime was found to differ from that of the dextro-compound, but there is no difference if the compounds are melted so that the inactive compound in the liquid state is but a mechanical mixture of the two active components; rapid crystallisation or solidification of the inactive compound also produces a mechanical mixture of the two modifications. L. M. J.

Salt Formation in Alcoholic Solution. By SIMEON M. TANATAR and BORIS KLIMENKO (*Zeit. physikal. Chem.*, 1898, **27**, 172—174).—In alcoholic solutions, the heat of neutralisation of a strong acid or alkali is not the heat of formation of water from its ions owing to the slight dissociation of the compounds, whilst for ammonia no water results from the neutralisation. The heat of neutralisation of benzoic acid by potassium hydroxide was found to be 6·847 cal., and by ammonia 12·643, whilst the corresponding values in the case of lactic acid were 7·180 and 14·031. In aqueous solution, the heat of neutralisation of benzoic acid by potassium hydroxide is 13·4 cal., an equal value being obtained for lactic acid and sodium hydroxide. The following values for the heat of dissolution were also obtained; benzoic acid, −3·168; potassium benzoate, −3·213; ammonium benzoate, −1·779 cal. L. M. J.

Crystalline Liquids. II. By RUDOLF SCHENCK (*Zeit. physikal. Chem.*, 1898, **27**, 167—171. Compare this vol., ii, 286).—Crystalline liquids are generally regarded as crystals, the internal friction of which is very small, and the author therefore determined the viscosity of some crystalline liquids and compared it with that of the same compounds in the isotropic state. The compounds examined were cholesterylic benzoate and parazoxyanisoil (this vol., ii, 286), and the viscosity relative to that of benzene was determined. For the first named compounds, determinations were made at 153·3°, 169·2° (crystalline), 180°, and 216° (isotropic), and it is seen that, at the transition temperature, there is a marked drop in the viscosity of the crystalline variety. The case of the parazoxyanisoil is different, the viscosity of the crystalline modification being considerably less than that of the isotropic form. L. M. J.

Application of the Equilibrium Law to the Formation of Oceanic Salt Deposits, with Especial Reference to the Stassfurt Beds. By JACOBUS H. VAN'T HOFF and WILHELM MEYERHOFFER (*Zeit. physikal. Chem.*, 1898, **27**, 75—93).—In order to deduce theoretically the order of deposition of salts in consequence of the evaporation of sea water, the relations of the individual salts present have to be first investigated, and the present paper deals with the solubility curves of the various hydrates of magnesium chloride, at temperatures from − 33·6° to + 186°, when evolution of hydrogen chloride commences. The complete equilibrium curve for the chloride and water may be divided into the following parts :—(1) Stable solution in equilibrium with ice, from 0° to 33·6° ; (2) stable solutions in equilibrium with the following hydrates, $MgCl_2 + 12H_2O$, from − 33·6° to − 16·8° ; $MgCl_2 + 8H_2O$, from − 16·8° to − 3·4° ; $MgCl_2 + 6H_2O$, from − 3·4° to 116·67° ; $MgCl_2 + 4H_2O$, from 116·67° to 181° ; $MgCl_2 + 2H_2O$, above 181° or 182° ; (3) labile solution in equilibrium with $MgCl_2 + 8H_2O$ (β) from − 17·4° to − 9·6°. Labile continuations of the curves for the hexahydrate and the dodecahydrate can be obtained meeting at − 30°, whilst similar continuations of the ice and octahydrate equilibrium curves cut at − 50°. The dodecahydrate was previously unknown, and is best produced by cooling a solution, containing a little more water than is required for the crystals, to about − 20°, and then inducing local overcooling by solid carbonic anhydride. The stable and labile octahydrates, also previously unknown, can be produced in a similar manner by cooling a solution of the composition $MgCl_2 + 11H_2O$. Once formed, the labile hydrate might remain unchanged for a whole day, but its production could not be depended on. The values found for the solubility of the hexahydrate were in general slightly lower than those of other observers, probably owing to more complete freedom from calcium chloride. For the solubility determinations at the highest temperatures, a special form of apparatus was employed, which is described in the paper with the aid of diagrams. L. M. J.

Equilibrium in the System, Water, Alcohol, and Ethylenic Cyanide. By FRANS A. H. SCHREINEMAKERS (*Zeit. physikal. Chem.*, 1898, **27**, 95—122).—Of these three pairs of liquids, two pairs, namely, alcohol–cyanide and water–cyanide, only form two liquid layers between the temperature limits of 13—31°, and 18·5—55·5° respectively, and this leads to some highly interesting cases of equilibrium. The equilibrium curve for water–ethylenic cyanide consists of three portions : (1) a portion, *ab*, from − 1·2 to 18·5 where the solid cyanide is in equilibrium with the solution and the quantity dissolved increases with temperature ; (2) the portion, *bdc*, where two liquid phases occur with the critical point of complete miscibility at 55·5° ; (3) the portion, *cs*, from + 18·5° to 54·5°, where the solid cyanide is in equilibrium with a liquid phase containing a high percentage of the cyanide. By the addition of alcohol, the temperature of the triple phase points, *b*, *c*, is reduced, and the curve, *bdc*, of two liquid phases becomes more and more flattened owing to the lowering of the temperature of complete miscibility. The region where separation into two layers occurs becomes more and more confined, and when the percentage of alcohol reaches 56·1 the points *b*, *d*, *c*, coalesce, and there is no region of two liquid phases. The alcohol–cyanide equilibrium curve is completely analogous, but the critical temperature is 31·1°, and is lowered by the addition of water, so that for 28·6 per cent. of water the two liquid phases region disappears. Hence separation into two layers only occurs with aqueous alcohol when the concentration of the alcohol is below 56·1 or above 71·4 per cent. From the solubility data, the equilibrium can be represented by a surface in an equilateral triangular prism where the long side is a temperature axis; on the faces of the prism are the equilibrium curves for each pair, and any section at right angles to the axis gives the isothermal for the triple equilibrium. A section passing through the cyanide edge of the prism and cutting the water–alcohol face gives the solubility curve of the cyanide in aqueous alcohol of the indicated composition, and it is hence seen that in 71·4 per cent. alcohol (which is approximately equimolecular) the solubility increases enormously with the temperature between 3° and 5·9°; at the lower temperature, 100 grams of the aqueous alcohol dissolve 42·3 grams of ethylenic cyanide, and at the higher temperature 305·5 grams. The isotherms are also interesting; in some cases, a line through the alcohol apex cuts the curve in three points, here, therefore, the effect of the addition of alcohol to the other components is to cause (1) dissolution of cyanide and production of homogeneous solution; (2) deposition of cyanide; (3) dissolution of deposited cyanide and re-formation of homogeneous solution. At a temperature of 5°, it is seen that, whilst 100 grams of alcohol dissolve 7 grams of cyanide, and 100 grams of water dissolve 6 grams of cyanide, yet 100 grams of 71 per cent. alcohol dissolve 232 grams, so that the solubility in this mixture is thirty times as great as in either component. At this temperature also, the addition of alcohol leads to very complicated results, causing (1) dissolution of cyanide; (2) separation into two liquid phases, in equilibrium with solid cyanide; (3) two liquid phases; (4) a homogeneous solution; (5) separation into two liquid phases; (6) further deposition of solid cyanide; (7) disappearance of one liquid phase; (8) disappearance of solid and production of homogeneous solution. Other very interesting features of the equilibrium are noticed, but for most of them the equilibrium diagrams are necessary. (See also Abstr., this vol., ii, 329, 424; 1897, ii, 483.) L. M. J.

Influence of Concentration on Reaction Velocities. By Alexander de Hemptinne (*Zeit. physikal. Chem.*, 1898, **26**, 728—738).—The reaction studied was the oxidation of an acidified solution of potassium iodide, an action which is dependent on temperature, light intensity, and the nature and concentration of the added acid. The variation of the velocity with the concentration of the potassium iodide showed the reaction to be one of the second order. The effect of light was found to be in the following order, white, yellow, green, red, and was independent of the acid employed. The effects of the different acids used gave the following order, hydrochloric acid, sulphuric acid, oxalic acid, acetic acid, and although this order is also that of the dissociation, yet the quantitative effects are not proportional to the dissociation. With acetic acid, the velocity of oxidation is at first proportional to the concentration of the acid, but at a concentration of about 50 per cent., the velocity increases enormously, reaches a maximum between 70 and 90 per cent., and again rapidly decreases. With sulphuric and hydrochloric acids also, the increase of velocity is far more rapid than the increase of concentration of the ions. It is worthy of note also that Spring and Aubel found that an increase of the velocity of dissolution of metals in acids occurred at a concentration of about 40 per cent. (Abstr., 1887, 1074). L. M. J.

Relative Velocity of Hydrolysis of Ethylic Salts of Normal Acids of the Oxalic Series. By Edvard Hjelt (*Ber.*, 1898, 31, 1844—1847).—The rate of hydrolysis (by soda) was determined at 17°, using N/20 solutions in 96 per cent. alcohol (Abstr., 1896, i, 205). The expression $x \div (A - x)\sqrt{t}$, has an approximately constant value, which is regarded as the constant of velocity of the hydrolysis. Side by side with the values of this are tabulated the values of the dissociation constants K_1 and K_2, of the first and second hydrogen atoms of these acids, as determined by W. A. Smith (this vol., ii, 285). It will be seen that here, when there are no changes, such as the introduction of a methyl group, likely to have a stereochemical effect on the constant of velocity, the latter decreases with the dissociation constant of the first hydrogen atom, and is not dependent on that of the second hydrogen atom, as Smith supposed it might be.

Acid.	Velocity constant.	$10^6 \times K_1$.	$10^6 \times K_2$.
Malonic	0·224	1580	1·0
Succinic	0·088	66·5	2·3
Glutaric	0·073	47·3	2·7
Pimelic	0·058	32·3	2·6
Suberic	0·042	29·9	2·5
Azelaic	0·037	25·3	2·7
Sebacic	0·037	23·8	2·6

C. F. B.

Report of the Committee on Atomic Weights. By Frank W. Clarke (*J. Amer. Chem. Soc.*, 1898, 20, 163—173).—A *résumé* of the work published during 1897 on the atomic weights of carbon, nitrogen, chlorine, silver, aluminium, nickel, cobalt, tungsten, and cerium; a corrected table of atomic weights of all the elements is appended. W. A. D.

Table of Atomic Weights. By Theodore W. Richards (*Amer. Chem. J.*, 1898, 20, 543—554).—The atomic weights of 74 elements are given, that of oxygen being taken as 16; the values are compiled from the most recent data, and, with the exception of those of the seven elements, antimony (120·0), cadmium (112·3), calcium (40·0), magnesium (24·36), platinum (195·2), tungsten (184·4), and uranium (240·0), are the same as those given by Clarke ("Smithsonian Collection of Constants of Nature," **5**, 1897). Reasons are given in detail for the choice made between the conflicting values for the atomic weights of the elements mentioned above. W. A. D.

Atomic Weight or Atomic Gravitation. By LUDWIG DULK (*Ber.*, 1898, **31**, 1865—1876).—This paper appears to be an account of a book published by the author (*Atomgewicht oder Atomgravitation*, Trewendt, Breslau, 1898), but is so condensed that it is hardly intelligible in itself. "This study is based on the recognised necessity of ceasing to regard matter as homogeneous. The atoms are no longer regarded as composed of different amounts of one and the same matter; they are conceived as systems of geometrical points, or of ether-vortices rotating about fixed positions of equilibrium. These bring the cosmic ether, which is conceived as continuous, into motion, the faster the nearer they lie to one another. This motion is assumed to be inversely proportional to the square of the distance, in accordance with the behaviour of all known forces that act at a distance, and in this way the gravitation of the atom, apparent to us as its atomic weight, is calculated." The atomic weights are calculated by means of some such expression as $n/a^2(1+b/2)$, in which the constants are determined by geometrical considerations; for example, a regular figure is taken with a number of sides (n) equal to the valency of the element, and such figures are arranged in a symmetrical system; the diameter of the circle circumscribing an individual figure being taken as unity, b is that of the circle circumscribing the system, and a is the length of the side of each figure. As another example of the methods employed, the atomic weight of copper may be quoted; this is calculated as

$$3\cdot\frac{1}{(\frac{1}{3})^2}\left(1+\frac{\sqrt{3}}{2}\right)+\frac{3}{2}\cdot\frac{1}{(\frac{1}{3})^4}\cdot\frac{1}{\left(\frac{2}{\frac{1}{3}}-2\right)^2}\left(1+\frac{1}{\sqrt{2}}\right)=63{\cdot}339.$$

In such ways as these, the following atomic weights are calculated:

Na = 23·06, K = 39·111, Rb = 84·96, Cs = 131·1, N = 14·0, O = 16·0, F = 18·928, B = 11·041, C = 11·9497, Si = 28·0, Cl = 35·464, Br = 79·666, I = 126·23, Cu = 63·339, Ag = 107·717, Au = 195·77, Hg = 198·45, Zn = 65·385, Cd = 112·0, Tl = 204·298.

The specific gravities of the elements, free or in combination, are also calculated by means of expressions of the form of either $x/a^2(\frac{1}{a}-1)$ or Y/a^2. For example, that of copper is

$$\frac{1}{(\frac{1}{3})^2}\cdot\frac{1}{3-1}\cdot 9\cdot 0{\cdot}220=8{\cdot}93.$$

C. F. B.

The Periodic System and the Properties of Inorganic Compounds. By JAMES LOCKE (*Amer. Chem. J.*, 1898, **20**, 581—592).—Although Mendeléeff's law is true as regards the physical and chemical properties of the elements themselves, it is, in the author's opinion, inaccurate to say that the nature of the compounds of an element is a function of its atomic weight. From this point of view, the character of the so-called "typical" elements is discussed. Athough lithium, beryllium, boron, and carbon, in the elementary state, are the strict homologues of the elements in the groups to which they belong, the compounds of beryllium are entirely different in character from those of any of the metals of the second group. Yet the compounds of the "typical" element lithium resemble in every respect those of the alkali metals; and the compounds of carbon those of silicon. Beryllium lies, as regards atomic weight, between lithium and carbon, so that its position as a typical element cannot be held to explain its anomalous character. Similarly, although fluorine as an element closely resembles the other halogens, many of its compounds differ from those of the latter in a very marked manner.

The proximity of cobalt and manganese to iron in the fourth series enables them to form well-defined double cyanides of the type $K_3MC_6N_6$, isomorphous with potassium ferricyanide; chromium and vanadium also (compare this vol., ii, 598), in the same series, form similar compounds, whilst the alums of the five elements named are isomorphous with those formed by titanium. The sesquioxide of scandium closely resembles that of titanium, yet all the other scandium compounds are similar to those of the rare earths. The proximity of scandium to titanium fails to confer on the tervalent compounds of the latter any single one of the properties of the rare earths.

W. A. D.

Cooling Pipette. By FRIEDRICHS (*Zeit. anal. Chem.*, 1898, **37**, 443).—A pipette for taking up hot liquids. The lower tube is contracted into a spiral; the upper is fitted with a caoutchouc ball.

M. J. S.

Pipette with Closing Appliance. By CARL SANDER (*Zeit. anal. Chem.*, 1898, **37**, 497).—The upper tube of the pipette is converted, by means of side apertures and a glass collar, into a kind of 3-way stopcock by which communication is established either with a permanently connected aspirator or with the external air. A figure is given.

M. J. S.

Some New Forms of Apparatus. By AUGUSTUS E. KNORR (*J. Amer. Chem. Soc.*, 1897, **19**, 817—820).—1. *An automatic filtering syphon.*—The longer limb of the syphon tube dips into the liquid in the funnel, and is closed by a ground conical glass valve, the lower part of which is blown out into a bulb, so that it rises with the level of the liquid and automatically stops the supply as soon as the funnel is full. The upper end of the valve stem bears a knob which, engaging with a constriction in the funnel tube, prevents the valve dropping out of the tube.

2. *A new form of gas generator.*—The solid substance required for the generation of the gas is placed in a calcium chloride tower, the acid being added from an acid funnel at the top. The novel feature of the apparatus is a U-shaped syphon tube inserted in the lower

opening of the tower, which is made of such a length that, while it allows the spent acid to flow away constantly, also acts as a hydraulic seal against the escape of gas. A. H.

An Efficient Gas-pressure Regulator. By PAUL MURRILL (*J. Amer. Chem. Soc.*, 1898, **20**, 501—504).—The apparatus, which is designed for use with a thermostat, consists of an inner and an outer vessel, the latter partially filled with water. The inner vessel, which can move freely up or down, is attached by means of a lever to the tap of the gas inlet tube; as gas enters, this vessel is lifted, at the same time closing the valve. If the outlets are closed, it rises until the valve is entirely closed, in which position it will remain; but when the exit tubes are opened, it falls, reopening the valve, admitting gas at the same rate at which it is consumed, and delivering it at a pressure which is measured by the weight of the inner vessel, *plus* or *minus* the resistance due to friction.

A. W. C.

New Form of Water Blast. By BERTRAM B. BOLTWOOD (*Amer. Chem. J.*, 1898, **20**, 577—580).—A convenient form of apparatus is described for supplying relatively small volumes of air at low pressure; it is claimed to be nearly three times more efficient, as regards the volume of water consumed per cubic foot of air supplied, than the forms described by Muenke and by Richards. For the details of construction, the original must be consulted. W. A. D.

Lecture Experiments with Liquid Air. By ALBERT LADENBURG (*Ber.*, 1898, **31**, 1968—1969).—The following experiments can readily be performed before a class by the help of Linde's modified apparatus. 1. Carbonic anhydride, when passed into liquid air, is at once precipitated as a white, snow-like powder. 2. Mercury at once becomes solid, and retains this form for some time. 3. Alcohol is insoluble in liquid air, but solidifies in hard, crystalline drops, which may be heard to rattle against the glass when the containing vessel is shaken. 4. Ozone can readily be liquefied to a deep blue, oily liquid. 5. Acetylene is at once solidified and can be pressed into cylinders in the same way as solid carbonic anhydride. 6. When concentrated hydrochloric acid is cooled for a few minutes in liquid air and a piece of potassium then added, no action occurs, but after standing in the open air for a short time explosive action occurs. 7. When liquid air is poured into water, the light blue drops fall to the bottom, but are driven upwards by the gas formed round their surface, the liquid air being in the spheroidal state. A. H.

Inorganic Chemistry.

Boiling Point of Liquid Ozone. By LOUIS TROOST (*Compt. rend.*, 1898, **126**, 1751—1753).—Ozone was liquefied in a vertical tube immersed in a bath of liquid oxygen, and the latter was then lowered until the readings of a galvanometer in circuit with a thermo-junction previously introduced into the tube were constant during the ebullition of the ozone. The boiling point of liquid ozone was thus found to be $-119°$ at the atmospheric pressure. N. L.

Action of Potassium Permanganate and of Sodium Peroxide on the Acids of Sulphur and of Iodine. By Antonio Longi and L. Bonavia (*Gazzetta*, 1898, **28**, i, 325—335).—The authors find that potassium permanganate, in alkaline solution, oxidises potassium sulphite, thiosulphate, trithionate, tetrathionate, sulphide, and polysulphide to potassium sulphate; potassium dithionate is not oxidised at all, and the oxidation of the tri- or tetra-thionate proceeds slowly. Potassium permanganate oxidises iodides quantitatively, in alkaline solutions containing not more than 0·05 gram per 100 c.c., in accordance with the equation $MI + Mn_2O_7 = MIO_3 + 2MnO_2$.

Sodium peroxide immediately and completely oxidises sulphites, thiosulphates, trithionates, tetrathionates, sulphides, and polysulphides, but acts very slowly on the dithionates; the peroxide has no action on iodates or iodides, but in very dilute solutions reacts with iodine forming iodide, whilst in more concentrated solutions the oxy-acids of iodine are produced. W. J. P.

Persulphates. By Hugh Marshall (*J. Soc. Chem. Ind.*, 1897, **16**, 396—399).—A *résumé* of the results obtained by the author (Trans., 1891, 771, and Abstr., 1891, 982) and by Elbs and Schönherr (Abstr., 1896, ii, 519). W. A. D.

Reduction of Thiosulphates to Sulphites in Alkaline Solution. By Rudolph F. Weinland and A. Gutmann (*Zeit. anorg. Chem.*, 1898, **17**, 409—421).—Sodium thiosulphate, when treated with sodium arsenite in concentrated solution, is reduced at the ordinary temperature with development of heat. The products are sodium monothio-oxyarsenate, $Na_3AsSO_3 + 12H_2O$, which crystallises out, and sodium sulphite, which remains in solution; a small quantity of arsenic is also precipitated. Potassium thiosulphate and potassium arsenite react in a similar manner, but the potassium monothio-oxyarsenate is obtained, after the sulphite has crystallised, on evaporating the mother liquors over sulphuric acid. A solution of calcium thiosulphate, when treated with sodium arsenite, yields a precipitate of calcium arsenite, and on heating the mixture, calcium monothio-oxyarsenate, calcium sulphite, and sodium monothio-oxyarsenate are formed.

Sodium hydrogen arsenite and sodium thiosulphate, when allowed to react at the ordinary temperature, yield sodium monothio-oxyarsenate, sodium sulphite, and a small quantity of arsenic. When, however, the mixture is heated, a yellowish-red product is obtained which does not contain thio-oxyarsenate. The corresponding potassium salts behave in a similar manner.

Sodium thiosulphate, when treated with sodium dihydrogen arsenite, is converted into sulphite; a considerable quantity of arsenic is precipitated, and then red arsenic bisulphide. The mother liquor from the sodium sulphite does not crystallise when allowed to evaporate over sulphuric acid, but when heated on the water bath it yields the thio-oxyarsenite, $Na_8As_{18}S_{24}O_7 + 30H_2O$.

Sodium thiosulphate, when heated with a concentrated solution of sodium antimonite, prepared from antimonyl sodium tartrate, in the proportions expressed by the formula $COONa \cdot C_2H_2(OH)_2 \cdot COOSbO + 4NaOH + Na_2S_2O_3$, is reduced to sulphite, with the formation of sodium pyroantimonate and sodium thioantimonate. A similar mixture of the potassium salts, when heated, yields potassium antimonate and potassium thioantimonate. If, however, the mixture is allowed to remain at the ordinary temperature, antimony trisulphide is precipitated, and the mother liquor, when evaporated to a syrup, yields crystals which decompose on recrystallisation, and give a red precipitate of antimony sulphide on treating with ammonium chloride. The compound is, therefore, probably potassium dithio-oxyantimonate, $K_2HSbS_2O_2 + 2H_2O$.

Sodium thiosulphate yields a precipitate of stannous sulphide, with a solution of sodium stannite. If this precipitate is separated by filtration, the mother liquor contains sodium stannate and sodium sulphite. If, however, the stannous sulphide is allowed to remain in the mother liquor, it slowly dissolves, and on concentrating, sodium stannate and sodium sulphite crystallise out, and then sodium thiostannate, $Na_4SnS_4 + 12H_2O$; the latter separates in beautiful, colourless to pale yellow crystals belonging to the monoclinic system; $a : b : c = 0{\cdot}90304 : 1 : 0{\cdot}36520$; $\beta = 92° \; 5'$. Potassium stannate and thiosulphate behave in a similar manner to the sodium salts. *Potassium thiostannate*, $K_4SnS_4 + 4H_2O$, which is precipitated from the final mother liquors by alcohol, crystallises in long, microscopic, white needles.

Sodium thiosulphate is without action on sodium plumbite at the ordinary temperature; and when heated on the water bath only a small quantity of lead sulphide and lead oxide are formed, the mother liquor containing most of the thiosulphate unaltered.

Phosphites, hypophosphites, and nitrites do not reduce thiosulphates either at the ordinary temperature or on boiling. A violent explosion takes place when a small quantity of a solution of sodium nitrite and sodium thiosulphate is evaporated to dryness, and then gently heated.

E. C. R.

Action of Sulphur Monochloride on Minerals. By Edgar F. Smith (*J. Amer. Chem. Soc.*, 1898, **20**, 289—293).—Stibnite and chalcocite dissolve in sulphur monochloride with great development of heat, antimony and cupric chlorides being produced respectively; artificially prepared arsenic trisulphide behaves similarly. Although a great rise in temperature occurs when arsenopyrite, chalcopyrite, cinnabarite, and tetrahedrite are brought into contact with sulphur monochloride, the minerals are only completely decomposed on heating to 140°; in each case, the corresponding metallic chloride is produced. Marcasite and pyrites are not acted on in the cold, although completely decomposed when heated at 140°; linnæite millerite, gersdorffite, and rammelsbergite have to be heated to 170°, and cobaltite, smaltite, and ullmannite to 180°, with sulphur monochloride, before decomposition is complete. Sphalerite and galenite are more resistant, but are completely dissolved on heating to 250°, whilst a temperature of

300° is necessary in the case of molybdenite. On heating the oxides of molybdenum, tungsten, tantalum, and columbium, as well as the minerals, wolframite, scheelite, and columbite, with sulphur monochloride, all were dissolved, and from the solutions obtained, beautiful crystals separated on cooling. It appears that, in the latter cases, sulphur monochloride acts as an oxidising as well as a chlorinating agent; this behaviour is also especially noticeable in the case of marcasite and chalcocite, which give rise to ferric and cupric chlorides respectively. W. A. D.

Atomic Weight of Tellurium. By RENÉ METZNER (*Compt. rend.*, 1898, **126**, 1716—1719).—The atomic weight of tellurium was determined by converting the element into the sulphate by the action of sulphuric acid, and also by reducing tellurous anhydride, in presence of metallic silver, by carbonic oxide. The tellurium employed was obtained in a very pure and crystalline condition by the decomposition of hydrogen telluride by heat, as recommended by Ditte, whilst the tellurous anhydride was prepared by heating to fusion, with exclusion of air, the product of the action of water on tellurium tetrachloride. The results obtained by the two different methods are in close agreement, the extreme values being 127·8 (mean of 3 determinations) and 128·24 (mean of 4 determinations), and the mean value 127·9 (standard not stated); these numbers are higher than those found by Brauner and by Staudenmaier. N. L.

Atomic Weight of Nitrogen. By MAURICE VÈZES (*Compt. rend.*, 1898, **126**, 1714—1716).—The difference between the value for the atomic weight of nitrogen, calculated from physical data (14·005), and that based on chemical analysis (14·044) is attributed by Berthelot and Leduc to the presence of dissolved oxygen in the metallic silver used by Stas in his determinations, a source of error to which attention was first directed by Dumas. The author points out that Stas himself, in a posthumous memoir, showed that the silver employed by him contained not more than $\frac{1}{35800}$ of its weight of oxygen, an amount too small to affect sensibly the atomic weights concerned. Applying the correction corresponding with this result, the atomic weight of nitrogen becomes 14·040, a number differing but little from the uncorrected value, but appreciably higher than that found by Berthelot and by Leduc. N. L.

The Reaction between Phosphorus and Nitric Acid. By CLEMENTE MONTEMARTINI (*Gazzetta*, 1898, **28**, i, 397—402).—Personne (*Bull. soc. chim.*, 1864, 163) and Maumené (*Ann. chim. phys.*, 1864, [iv], **3**, 319) have shown that ammonia is formed during the action of nitric acid on phosphorus. The author finds on exposing red phosphorus to the action of excess of 17·3, 28·3, and 68 per cent. nitric acid at 13—14° until all is dissolved, that 1 gram of phosphorus causes the production of 0·0739, 0·0824, and 0·0095 gram of ammonia respectively as the mean of four experiments with each concentration of acid. The results of the individual experiments differ considerably, and the time required for solution of the phosphorus also varies.

W. J. P.

Action of Sodammonium in Excess on Red Phosphorus. By C. Hugot (*Compt. rend.*, 1898, **126**, 1719—1722. Compare Abstr., 1896, ii, 20).—When a mixture of weighed amounts of red phosphorus and sodium is left in contact with liquid ammonia, a yellow, crystalline substance of the formula $P_2H_3Na_3$ is produced, hydrogen phosphide and sodamide being simultaneously formed. This compound is decomposed by acids and by water, with liberation of hydrogen phosphide; and when heated in a vacuum above 100°, loses hydrogen phosphide and hydrogen. An excess of sodium must be employed in its preparation, otherwise sodium phosphamide, PH_2Na, and other compounds are also produced. N. L.

Existence of Orthosilicic Acid. By Thomas H. Norton and D. M. Roth (*J. Amer. Chem. Soc.*, 1897, **19**, 832—835).—The substance obtained by washing precipitated silicic acid, prepared from silicon fluoride, with benzene or absolute ether, and then rapidly pressing the product between sheets of bibulous paper, has the composition required by the formula H_4SiO_4. It is an amorphous, white powder which loses its water steadily on exposure to the air, especially when in contact with absorbent media. Thus if the pressing between filter papers be continued after the ether has been removed, rapid loss of water takes place, as much as 10 per cent. of the total water being in some cases lost in 5 minutes. Absolute alcohol cannot be used instead of ether, as it causes rapid dehydration. The authors consider that these experiments establish the existence of orthosilicic acid as a definite compound. A. H.

Carbonic Anhydride in the Atmosphere. By Albert Lévy and H. Henriet (*Compt. rend.*, 1898, **126**, 1651—1653).—The error which, as shown by Gautier (this vol., ii, 641), arises from the use of potash instead of baryta as an absorbent for carbonic anhydride, is too small to sensibly affect the results of the daily observations carried out by the authors during the last twenty years. A series of duplicate estimations with both absorbents show that in the neighbourhood of the country the results obtained by the use of potash and of baryta are identical; in the centre of the town, however, baryta often gives higher results than potash, the difference amounting sometimes only to one-millionth of the volume of air employed, and sometimes to thirty times this amount. In the latter case, however, it is found that the same results are obtained with potash as with baryta if the air is left in contact with the alkali for a sufficiently long time. This fact, together with the results of other experiments to be described hereafter, induce the authors to believe that the alkalis not only absorb the carbonic anhydride actually present in the air, but also, and with different rapidity, facilitate the oxidation of the carbon contained in the organic matter existing in the atmosphere. The existence of such organic matter is proved by the fact that if a sample of air, giving different results with potash and baryta, is passed over heated cupric oxide and the carbonic anhydride again determined, identical results, slightly higher than before, are obtained with the two alkalis. Experiments made with air at the level of the soil tend to show that the earth is the principal source of these gaseous organic substances, and that the latter are, in the country, oxidised by atmospheric ozone. It is also suggested that the relatively large proportion of carbonic anhydride present in fogs, as well as the odour of the latter, are closely connected with the existence of gaseous organic compounds, and with phenomena of condensation brought about by sudden alterations of pressure. N. L.

Limits of Inflammability of Carbonic Oxide. By HENRI LE CHATELIER and O. BOUDOUARD (*Compt. rend.*, 1898, **126**, 1344—1347).—Mixtures of carbonic oxide and air are explosive when containing from 15·9 to 74·5 per cent. of the combustible gas, the experiments being carried out in a tube of 40 mm. diameter. If narrow tubes be employed, the limits of inflammability approach each other, and for tubes of less than 2·3 mm. diameter there is no explosive mixture. The inflammability diminishes rapidly with the pressure, and increases with rise of temperature. Mixtures of carbonic oxide and acetylene with air are found to obey the relation, previously found to hold for mixtures of methane and coal-gas, $\frac{n}{N}+\frac{n^1}{N^1}=1$ where n and n^1 are the lower limits of inflammability of the mixtures, and N and N^1 are the limits for each of the two combustible gases when separately mixed with air. This relation is found to hold only approximately for mixtures of carbonic oxide and hydrogen with air. N. L.

Limits of Inflammability of Combustible Vapours. By HENRI LE CHATELIER and O. BOUDOUARD (*Compt. rend.*, 1898, **126**, 1510—1513, —The authors have determined the limit of inflammability of the vapours of a large number of carbon compounds, and find that, except in the case. of carbon bisulphide, the molecular heat of combustion of the limiting mixture lies between 9 Cal. and 13 Cal., and in most cases is between 12 Cal. and 13 Cal. The quantity of oxygen consumed in the combustion of these mixtures also varies but little, and is about 11·5 per cent. of the total volume. C. H. B.

New Atmospheric Gases. By WILLIAM RAMSAY and MORRIS W. TRAVERS (*Compt. rend.*, 1898, **126**, 1762—1763.)—Two new gases, for which the names *neon* and *metargon* are proposed, were obtained by the fractional distillation of liquid argon. The first fractions consisted of neon, the spectrum of which is characterised by a large number of strong lines in the orange-red and yellow, and some lines in the deep violet. Towards the end of the distillation, a solid substance was formed which volatilised very slowly and could therefore be obtained in a high state of purity. This gas, metargon, has a density (19·87) almost equal to that of argon (19·94), but its spectrum is quite different. Among the numerous lines which it exhibits, there is one in the green occupying a position not yet recognised and one in the yellow at λ5849·6. The latter is not coincident with the similar lines of krypton and helium, which are at λ5866·5 and λ5875·9 respectively. Both neon and metargon are monatomic gases, the ratio of the two specific heats being in each case 1·66. The intermediate fractions obtained in the distillation of liquid argon are still under examination. N. L.

Action of Sulphur on Sodium. By JAMES LOCKE and ALFRED AUSTELL (*Amer. Chem. J.*, 1898, 20, 592—594).—Quantities of sulphur corresponding with the compounds Na_2S, Na_2S_2, Na_2S_3, Na_2S_4, and Na_2S_5, were dissolved in hot toluene, and added to sodium covered with the same solvent at its boiling temperature; until the amount of sulphur was sufficient to form the compound Na_2S_3, a considerable quantity of sodium remained unacted on. Products of practically the same composition (28·89 and 28·57 per cent. of sodium respectively) were obtained in the two cases where the quantities were those required to form Na_2S_3 and Na_2S_4; both products probably consisted of a mixture of these two substances.

From the above results, it appears that sodium monosulphide is not formed by the direct combination of sodium and sulphur at the temperature of boiling toluene; the same result was obtained at the temperature of boiling naphthalene (218°). W. A. D.

Ammonium Selenide. By VICTOR LENHER and EDGAR FRANCIS SMITH (*J. Amer. Chem. Soc.*, 1898, 20, 277—278).—On saturating with hydrogen selenide a solution of 5 grams of ammonium molybdate in 50 c.c. of water to which 20 c.c. of strongest aqueous ammonia had been added, a dark red solution was obtained, from which, on evaporation black, anhydrous, orthorhombic prisms of ammonium selenide separated. The crystalline product was stable in the air, and dissolved in water to a dark red solution which gave a precipitate of selenides from neutral or alkaline solutions of metallic salts; the solution, however, gradually decomposed on exposure to the air, selenium being precipitated.

The selenium was determined in the crystalline salt by a method communicated by H. F. Keller. A weighed quantity of the substance was dissolved in very dilute caustic soda, and an excess of hydroxylamine hydrochloride added; on boiling the solution for several minutes, selenium was precipitated, which was collected, dried at 105°, and weighed.

It is noteworthy that only from ammoniacal molybdate solutions of the concentration given can the black crystals of ammonium selenide be obtained; under other conditions, selenium alone is formed.

W. A. D.

Some Reactions of Ammonium Salts. By WATSON SMITH (*J. Soc. Chem. Ind.*, 1895, 14, 629—631).—Nearly pure ammonium hydrogen sulphate can be prepared by heating the normal sulphate initially at 300—320° in a platinum dish, and finally almost to dull redness. Nitrogen is not liberated from ammonium hydrogen sulphate at temperatures up to 360°, but is rapidly evolved at 450°, when the residue contains a considerable quantity of ammonium sulphite. On heating finely powdered ammonium sulphate at 160°, ammonia is rapidly evolved, ammonium hydrogen sulphate being formed; if, however, gaseous ammonia is passed through the latter in the fused state at 310—320°, it is absorbed until 70 per cent. of the salt is converted into normal ammonium sulphate; at 350—360°, however, 46·8 per cent., and at 410—420°, 85·6 per cent., of the ammonium hydrogen sulphate remains unacted on. If a slow current of gaseous ammonia is passed through the fused salt at 420°, a partial reduction to sulphite takes place, and nitrogen is liberated. If, in any of the above experiments a stream of air be substituted for the ammonia after the limit of absorption of the latter has been reached, ammonia is rapidly evolved, even at temperatures considerably below those at which the absorption took place.

In the light of the above results, the author discusses Hodgkinson and Bellairs' observations (Proc., 1895, 114) on the action of metals on fused ammonium sulphate. It is pointed out that ammonium sulphate as such does not melt, but that when heated it is converted into ammonium hydrogen sulphate, with loss of ammonia; if, therefore, the normal salt were employed in the experiments cited, the evolution of ammonia at 160° cannot be attributed to the action of the metals on the salt, but simply to the spontaneous decomposition of the latter; ammonium hydrogen sulphate, however, melts at 146°, but is only decomposed at a temperature considerably above 160°, so that if this were employed, the ammonia evolved must be considered due to the action of the metals. That little hydrogen was obtained is explained by its reducing action in the nascent state on the sulphate, ammonium sulphite being produced. As regards the action of metals on fused ammonium nitrate, Veley has shown (*Phil. Trans.*, 1888, 257) that the latter dissociates into ammonia and nitric acid at a temperature somewhat below that "at which it undergoes resolution"; the results obtained by Hodgkinson and Bellairs were, therefore, probably due to the action of this nitric acid on the metals employed, and not to the direct interaction of the latter with the salt. W. A. D.

Comparative Affinities in the Case of Certain Salts of Ammonium and Sodium. By WATSON SMITH (*J. Soc. Chem. Ind.*, 1896, 15, 3—8. Compare preceding abstract).—On passing steam through ammonium sulphate at 270—310°, ammonia is at first rapidly evolved, although the evolution becomes slower as the quantity of ammonium hydrogen sulphate formed increases; no sulphurous acid is liberated. When ammonium sulphate is heated in a current of moist air, ammonia begins to be evolved at temperatures varying from 105° to 177°, according to the physical condition of the salt; on heating neutral solutions of the salt, ammonia begins to be given off perceptibly at 60°, and, on boiling, the solution gradually becomes acid.

99·1 per cent. of the ammonia theoretically lost in the conversion of ammonium sulphate into ammonium hydrogen sulphate is evolved on heating the dry salt at 300° during 8 hours, and rapidly removing the gases formed by means of an aspirator. Under these conditions, 0·146 per cent. only of the sulphuric anhydride is liberated as sulphurous anhydride. When, however, ammonium hydrogen sulphate is heated in a bulb freed from air at 300—350°, large quantities of sulphurous anhydride are evolved, whilst the residue consists almost entirely of sulphite; as, however, practically no nitrogen is formed, it is doubtful whether the reduction takes place according to the equation $3NH_4HSO_4 = N_2 + NH_4HSO_3 + 5H_2O + 2SO_2$. The fact that no ammonia is evolved when ammonium sulphate is heated with concentrated sulphuric acid at 300°, is in accord with the known accuracy of Kjeldahl's method of estimating nitrogen.

When ammonium hydrogen sulphate is fused with oxalic acid, the latter is immediately decomposed into carbonic oxide and anhydride. A peculiar series of changes takes place when ammonium chloride is heated with an equivalent quantity of ammonium sulphate, either in the dry state or in solution. In both cases, ammonia is first evolved with the production of ammonium hydrogen sulphate; after a time, however, this interacts with the ammonium chloride, ammonium sulphate being formed, whilst hydrogen chloride is evolved. As the amount of normal sulphate formed increases, a condition of equilibrium is reached, at which hydrogen chloride ceases to be liberated, and the sulphate begins to decompose with evolution of ammonia. The above cycle of changes is repeated as long as the saline mixture is heated. When ammonium chloride is heated with ammonium hydrogen sulphate, hydrogen chloride is initially evolved; after a time, however, the ammonium sulphate formed decomposes, and regenerates ammonium hydrogen sulphate with loss of ammonia, so that the action is not continuous. In order to completely decompose the chloride, a large excess of the acid sulphate is necessary; under these circumstances, the ammonium sulphate formed is decomposed only with very great difficulty.

Corresponding to the above, on adding common salt to fused ammonium hydrogen sulphate, hydrogen chloride is evolved, and sodium ammonium sulphate formed; the reaction is, however, incomplete, and a small quantity of sulphite is formed. On furthur heating, ammonia is evolved and sodium hydrogen sulphate produced.

When ammonium chloride is heated with ammonium hydrogen sulphate and an excess of manganese dioxide, nearly 15 per cent. of its chlorine is evolved; sodium chloride, under similar conditions, yields about 20 per cent. of chlorine, whilst from a mixture of ammonium chloride (1 equiv.), sodium hydrogen sulphate (4 equivs.), manganese dioxide (4 equivs.), and a little water, as much as 83 per cent. of the combined chlorine was obtained, sodium ammonium sulphate being formed. This appears to crystallise with $3H_2O$, and not with $2H_2O$ as usually stated, and on being heated evolves ammonia perceptibly at 78°; during 13 hours at 300—305°, 66·57 per cent. of the ammonia is evolved, but no sulphurous anhydride is formed. At 450°, a further quantity (7·7 per cent.) of ammonia is given off, but slight reduction to sulphite also takes place. The remaining portion of the ammonia appears to be more firmly retained by sodium hydrogen sulphate, in presence of an excess of the latter, than by ammonium sulphate, when a corresponding excess of ammonium hydrogen sulphate is present.

W. A. D.

Structural Isomerism in Inorganic Compounds. By ALEXANDER P. SABANÉEFF (*Zeit. anorg. Chem.*, 1898, 17, 480—493).—The author describes seven pairs, and a series of three metameric inorganic compounds. The first pair, hydroxylamine hypophosphite and ammonium dihydrogen phosphite, have already been described (Abstr., 1897, ii, 170).

Hydroxylamine dithionate, $(NH_3O)_2H_2S_2O_6$, is obtained by the action of hydroxylamine sulphate on barium dithionate. When the solution is evaporated at the ordinary temperature, a crystalline mass is obtained, together with a few large crystals which are similar in appearance to ammonium nitrate; it is partially decomposed when heated on the water bath, and at 120° is converted into hydroxylamine sulphate and sulphurous anhydride. It is isomeric with ammonium persulphate $(NH_3)_2H_2S_2O_8$.

Hydrazine phosphite, $N_2H_4H_3PO_3$, obtained from barium phosphite and hydrazine sulphate, is very hygroscopic and melts at 36°. It is isomeric with ammonium hydrogen amidophosphate, which decomposes at 120° and melts at 305°.

Hydrazine hydrogen phosphite, $N_2H_4(H_3PO_3)_2$, obtained from hydrazine sulphate and barium hydrogen phosphite, melts at 82° without decomposition. It is isomeric with ammonium hypophosphate, $(NH_3)_2H_4P_2O_6$, which melts at 170° (Salzer, Abstr., 1879, 106; 1882, 461).

Hydrazine phosphate, $N_2H_4H_3PO_4$, obtained from hydrazine sulphate and barium phosphate, or by neutralising phosphoric acid with hydrazine hydrate, melts at 82°. It is isomeric with hydroxylamine amidophosphate, $NH_3O \cdot NH_2PO(OH)_2$, which decomposes at 95°.

Acid hydrazine phosphate, $N_2H_4(H_3PO_4)_2$, obtained from the barium salt, $Ba(H_2PO_4)_2$, is isomeric with *hydroxylamine hypophosphate*, $(NH_3O)_2H_4P_2O_6$, which melts and decomposes at 139°.

Hydrazine hypophosphate, $N_2H_4H_4P_2O_6$, obtained by neutralising hypophosphoric acid with hydrazine hydrate and then adding an equal quantity of hypophosphoric acid, is sparingly soluble in water and melts at 152°. It is isomeric with ammonium dimetaphosphate, $(NH_4PO_3)_2$, which, according to the cryoscopic results and the electric conductivity described by Tammann (*Zeit. physikal. Chem.*, **6**, 122) has the above formula.

Ammonium hydroxylaminosulphonate, $NH(OH) \cdot SO_3NH_4$, is obtained by boiling a solution of potassium hydroxylaminosulphonate (*Annalen*, **241**, 187) for a few minutes, then adding an excess of barium chloride, and after filtration adding barium hydroxide, whereby barium hydroxylaminosulphonate is precipitated; finally the latter is decomposed with ammonium sulphate; it is a crystalline mass which decomposes if kept. It is isomeric with hydroxylamine amidosulphonate, $NH_3OH \cdot NH_2SO_3$, and also with hydrazine sulphate, $N_2H_4H_2SO_4$.

E. C. R.

Preparation of Crystallised Calcium. By HENRI MOISSAN (*Compt. rend.*, 1898, **126**, 1753—1758).—The author has repeated much of the work of previous experimenters, and finds that none of the processes hitherto employed are capable of yielding metallic calcium in a pure state. The separation of the metal from its amalgam is impracticable, the residue left on distillation being always impure. In the electrolysis of fused mixtures of salts of calcium and the alkali metals, the latter are the first to be liberated and then take part in the reaction. When calcium salts are reduced by metallic sodium, a mixture of the two metals is always obtained, a state of equilibrium being finally reached which depends on the temperature and the relative proportions of the salts employed. Heating in contact with hydrogen or nitrogen must be avoided in the preparation of calcium, since under these conditions the hydride, CaH_2, or the nitride are formed. Either of the two following methods yields metallic calcium in a pure crystalline state.

1.—Coarsely powdered, anhydrous calcium iodide (600 grams) is heated to dull redness in a closed iron crucible with 240 grams of sodium in small pieces. The calcium formed dissolves in the excess of sodium, from which it crystallises, on cooling, in brilliant, white, hexagonal crystals, which remain undissolved when the contents of the crucible are broken up and treated with absolute alcohol. The crystals are washed with ether and dried at the ordinary temperature in a current of dry carbonic anhydride or hydrogen. The yield in this process is about 50 per cent.

2.—Calcium iodide is fused at a dull red heat and electrolysed between a negative electrode of pure nickel and a positive electrode consisting of a cylinder of graphite. The metal is obtained either in fused globules or in crystals similar to those already described. The study of this reaction will be continued.

The metal obtained by the first process was found, by analysis, to contain 99 per cent. of calcium. N. L.

Phosphorescent Mixtures containing Strontium Sulphide. By José Rodriguez Mourelo (*Compt. rend.*, 1898, **126**, 1508—1510). —Further experiments with mixtures of strontium, barium, and calcium sulphides with one another and with indifferent substances lead to the conclusions that (1) at least 2·5 per cent. of the active substance must be present, and beyond this limit the phosphorescence increases with the proportion of the active substance; (2) a longer exposure to diffused light is necessary when indifferent substances are present; (3) the intensity of the phosphorescence is greatly increased by the addition of small quantities of sodium carbonate and chloride and bismuth subnitrate to the mixture from which the sulphide is prepared; (4) the colour of the phosphorescence is always the mean colour of the separate phosphorescences of the active substances present, and (5) in the preparation of the sulphide the best temperature is a cherry-red heat, but if this temperature be exceeded or the action of heat be too prolonged, the product will probably be non-phosphorescent.

C. H. B.

Sulphantimonites of Barium, Strontium, and Calcium. By Pouget (*Compt. rend.*, 1898, **126**, 1792—1793).—*Barium orthosulphantimonite*, $Ba_3Sb_2S_6 + 8H_2O$, obtained by warming antimony sulphide with a solution of barium sulphide or barium hydrogen sulphide, crystallises in small, white scales, which become yellow on exposure to dry air. When antimony sulphide is treated with barium sulphide solution in the cold, *barium pyrosulphantimonite*, $Ba_2Sb_2S_5 + 8H_2O$, is obtained as a greenish-grey, crystalline mass. Both these salts are decomposed by water with formation of a chestnut-yellow, amorphous *compound* of the composition $Ba_3Sb_4S_9 + 10H_2O$.

Strontium orthosulphantimonite, $Sr_3Sb_2S_6 + 10H_2O$, obtained in a similar manner to the barium salt, crystallises in white scales. By evaporating the mother liquor, small yellow crystals of the *pyrosulphantimonite*, $Sr_2Sb_2S_5 + 15H_2O$, are obtained. The same salt is produced by the action of strontium sulphide solution on antimony sulphide in the cold. It is soluble in water without appreciable decomposition.

Calcium pyrosulphantimonite, $Ca_2Sb_2S_5 + 15H_2O$, obtained by warming antimony sulphide with calcium hydrogen sulphide solution, and evaporating the liquid in a vacuum, forms large, colourless crystals which, like those of the strontium salt, belong to the anorthic system and are soluble in water without decomposition. If the solution, however, is concentrated by heating, a *compound* of the formula SbS_2CaOH is formed, which crystallises in red scales and is insoluble in water.

All the compounds described are readily oxidised by exposure to air, and should be prepared in a current of hydrogen. It may be observed that the analogy between calcium and strontium is shown in the pyro-salts, and that between strontium and barium in the ortho-salts.

N. L.

Magnesium Phosphates. By HEINRICH STRUVE (*Zeit. anal. Chem.*, 1898, **37**, 485—496).—Magnesium ammonium orthophosphate, as obtained by precipitation, has the formula $MgNH_4PO_4 + 6H_2O$. The same compound is obtained when the basic magnesium phosphate, $2MgO,P_2O_5,7H_2O$, discovered by the author (Abstr., 1897, ii, 372) is digested with excess of ammonia solution at ordinary temperatures for some months. It is permanent in the air at 30°, but in a desiccator over sulphuric acid (between 25° and 30°) it loses both ammonia and water, and in the course of 3 months is reduced to

$$4MgO,(NH_4)_2O,2P_2O_5,H_2O.$$

Boiled with water, it gives up one-third of its ammonia and half its water, yielding the insoluble compound $6MgO,2(NH_4)_2O,3P_2O_5,18H_2O$. At higher temperatures, in a current of hydrogen, it loses the whole of its ammonia and water, giving a white residue, which at a red heat becomes incandescent without change of weight, and turns grey from the deposition of traces of carbon derived seemingly from organic substances in the ammonia used for its preparation. This carbon burns off when the residue is heated in oxygen. If the original compound is heated in air instead of in hydrogen, it begins to lose ammonia at 60°, and water at 80°. After the loss of two-thirds of its ammonia and at a low red heat, red vapours, consisting of nitrogen oxides, are given off. The cause of the incandescence is as yet obscure; it sometimes fails to occur with pure preparations, and it is not prevented by an admixture of calcium phosphate. Magnesium ammonium phosphate immersed in glycerol is, at ordinary temperatures slowly, at high temperatures rapidly, converted into $2MgO,P_2O_5 + 7H_2O$.

M. J. S.

Beryllium Iodide. By PAUL LEBEAU (*Compt. rend.*, 1898, **126**, 1272—1275).—When beryllium carbide is heated at about 700° in a current of hydrogen, or, better, dry hydrogen iodide, carrying iodine vapour, it is readily converted into beryllium iodide, which condenses in colourless crystals, of sp. gr. = 4·2 at 15°. Traces of ferric iodide can be removed, if necessary, by resublimation in a current of carbonic anhydride.

Beryllium iodide alters readily in moist air; it melts at about 510°, and partially sublimes before melting, but boils between 585° and 595°. It distils without change in an atmosphere of hydrogen or nitrogen, but when heated in air it burns below a red heat. It is readily decomposed by fluorine, chlorine, bromine, cyanogen, hydrogen sulphide, sulphur, sodium, potassium, lithium, and magnesium, but not by aluminium, copper, or mercury below the softening point of glass. It reacts with a large number of carbon compounds, especially those containing oxygen, but has no action on carbon tetrachloride or dichloride. With ammonia, it forms the compound $2BeI_2,3NH_3$, and it also yields crystallisable products with aniline, pyridine, and other organic bases. When crystallised, the iodide very readily combines with water, but it is more stable after being melted. It is insoluble in most organic solvents, except alcohols, with which it forms crystalline compounds. C. H. B.

Preparation and Properties of Anhydrous Beryllium Fluoride and Oxyfluoride. By Paul Lebeau (*Compt. rend.*, 1898, **126**, 1418—1421).—The product described by Berzelius as anhydrous beryllium fluoride, obtained by dissolving the oxide in hydrofluoric acid, evaporating to dryness, and drying at 100°, always contains water, and on heating to redness yields an oxyfluoride, which analysis shows to have the composition $5BeF_2,2BeO$. This is a colourless, nearly transparent, solid, readily soluble in water, and having a sp. gr. = 2·01 at 15°. Anhydrous beryllium fluoride may, however, be obtained by heating the moist substance to redness in a current of hydrogen fluoride, or by igniting the double fluoride of ammonium and beryllium in an atmosphere of carbonic anhydride. It is a deliquescent, vitreous solid of sp. gr. = 2·1 at 15°, which softens on heating, becomes quite fluid at about 800°, and finally volatilises with formation of a crystalline sublimate. It dissolves in water in all proportions, and is also soluble in alcohol. Oxygen converts it into the oxyfluoride, but the vapour of sulphur is without action. It is decomposed by sulphuric acid, and also on heating to redness with potassium, sodium, or magnesium. Beryllium fluoride is insoluble in anhydrous hydrofluoric acid, a fact which renders improbable the existence of beryllium hydrogen fluoride. N. L.

Beryllium Borocarbide. By Paul Lebeau (*Compt. rend.*, 1898, **126**, 1347—1349).—When a mixture of beryllium oxide (75 parts) and boron (45 parts), contained in a carbon crucible, is heated for a short time in the electric furnance, a *compound* is formed which analysis shows to have the composition $C_4B_6Be_6$. *Beryllium borocarbide* forms brilliant crystals of metallic lustre, having a sp. gr. = 2·4, and readily soluble in mineral acids. It is not altered by exposure to air at the ordinary temperature, but suffers superficial oxidation on heating to redness; it burns in chlorine at about 450° with production of boron chloride, beryllium chloride, and amorphous carbon.

N. L.

Atomic Weight of Cadmium. By HARMON N. MORSE and H. B. ARBUCKLE (*Amer. Chem. J.*, 1898, **20**, 536—542).—The authors have repeated the experiments of Morse and Jones (Abstr., 1892, 1397) on the atomic weight of cadmium, taking into account the weight of gas occluded by the oxide formed on igniting cadmium nitrate. The occluded gas, consisting entirely of oxygen and nitrogen, was analysed by the method previously adopted by the authors in determining the atomic weight of zinc (this vol., ii, 334). No trace of nitric oxide could be detected in the cadmium oxide obtained in the several determinations. On account of the volatility of cadmium oxide at high temperatures, the crucibles containing the nitrate were maintained at a temperature intermediate between the fusing points of sodium chloride (776°) and potassium carbonate (835°); under these conditions, no volatilisation occurred. The amount of mixed gases occluded per gram of cadmium oxide varied in nine experiments from 0·243 to 0·262 c.c.; none of this was removed by exposure under water in a vacuum, or on boiling with water under atmospheric pressure.

The average of nine experiments, ranging from 112·359—112·395 gives 112·377 as the corrected value for the atomic weight of cadmium (oxygen = 16). This agrees very closely with the values 112·39 and 112·38 obtained by Bucher, working with the chloride and bromide of the metal.

W. A. D.

Metallic Precipitation. By DONATO TOMMASI (*Bull. Soc. Chim.*, 1897, [iii], **17**, 440—441).—In his work on metallic precipitation (Abstr., 1897, ii, 171), Senderens omits all mention and appears to be ignorant of the fact that the author had already fully investigated the action of aluminium on solutions of copper chloride in 1882.

H. C.

Alloys. By M. HERSCHKOWITSCH (*Zeit. physikal. Chem.*, 1898, **27**, 123—166).—Notwithstanding the work of Laurie (Trans., 1894, 1030) on the E. M. F. of alloys, of Matthiesen on their electrical conductivity (*Phil. Trans.*, 1860, **150**, 161), and of others, the existence of actual chemical compounds in alloys is still doubtful, and the author therefore investigated the question in a manner similar to that adopted by Laurie, that is, by the determination of the difference of potential between the alloy and the pure metal in a voltaic cell, employing as electrolyte a solution of a salt of the metal under examination, a necessity not observed by Laurie. The following cases are possible. (1) The metals are present in the pure state, or the alloy is a mechanical mixture; the potential in this case is constant, being that of the less noble metal. (2) The metals are partially soluble; the potential is constant during the existence of the same two phases, but when one phase, that is, the metal previously in excess, disappears, the potential takes a value intermediate between the previous value and the final. (3) The metals are completely soluble; the potential varies continuously between the extreme values. (4) Chemical compounds are formed; in this case, a sudden change of potential occurs at a concentration which is that of the compound. Alloys of the following pairs were examined, the composition in each case being varied within very wide limits. Cadmium–lead, cadmium–tin, cadmium–bismuth, zinc–tin, zinc–bismuth, copper–silver, zinc–copper, zinc–silver, zinc–antimony, tin–copper, and tin–silver; the potential was in all cases measured against that of the first named metal in a solution of one of its salts. In the case of the first six pairs, the potential of the alloy remained constant until a very low percentage of the first metal was reached, when it continuously fell to the second value, that is, the alloys were of the second kind. In all the other pairs of alloys, a compound was indicated by a sudden fall of potential, the compounds being respectively, Zn_2Cu, Zn_4Ag, $ZnSb_2$, Cu_3Sn, Ag_4Sn; the formation of the two last compounds is in accord with previous observations. Alloys of copper–antimony, bismuth–antimony, gold–silver, and aluminium–tin could not be investigated, as the last alloy decomposed water, whilst in the others the potentials of the components are too nearly equal. The heat of formation of some of the alloys was also determined by measuring the heat of formation of the bromides from moist bromine. In all the cases examined, the values differed from those calculated for the mixture, even when the potential determinations indicate no chemical compound. A maximum occurs in the copper–tin at a concentration represented by Cu_3Sn; in the case of the copper–zinc curve, no such analogous maximum occurs, but the heat development is so slight that its presence might be masked by the experimental errors.

L. M. J.

Equilibrium of a Tertiary System: Lead, Tin, Bismuth. By GEORGES CHARPY (*Compt. rend.*, 1898, **126**, 1569—1573).—Lead, tin, and bismuth mix in all proportions, and form neither definite compounds, nor solid solutions, nor isomorphous mixtures. An alloy of the three metals, therefore, presents the simplest possible case of a system of three constituents in which there are three solid phases, but one liquid phase. The author has determined the melting points of a large number of such alloys, and represents the results by means of one of Thurston's triangular diagrams. Each alloy is represented by a point within an equilateral triangle, at distances from the sides proportional to the relative quantities of the three metals. The angles represent the pure metals, and points on the sides represent binary alloys. The melting points of the alloys are represented by perpendiculars, the heights of which are proportional to the melting points, and the locus of the upper extremities of these perpendiculars is a surface which represents the relation between the melting points of the alloys and their composition. The author first determined the melting points of a number of alloys represented by points falling on one straight line, for example, constant proportions of lead and bismuth, with variable proportions of tin, or constant proportions of lead and tin with variable proportions of bismuth. From the plane curves thus obtained, the isothermals of the surface can be constructed by graphic interpolation. The eutectic mixture of the three metals contains 32 per cent. of lead, 16 per cent. of tin, and 52 per cent. of bismuth, and melts at 96°. An examination of the surface makes it possible to predict the behaviour of any other alloy as it cools from a temperature above its melting point. C. H. B.

Constitution of Ternary Alloys. By GEORGES CHARPY (*Compt. rend.*, 1898, **126**, 1645—1648. Compare Abstr., 1897, ii, 406).—The solidification of an alloy of lead, tin, and bismuth takes place in three stages characterised by definite temperatures. In the first stage, a pure metal separates, either lead, tin, or bismuth, according to the percentage composition of the alloy; in the second, a mixture of two of these metals separates, and in the third stage, all three metals are deposited simultaneously. The existence of the three different deposits is readily proved by microscopic examination of a thin polished section of the alloy, etched with dilute hydrochloric acid. An alloy containing 74·5 per cent. of bismuth, 5·5 per cent. of lead, and 20 per cent. of tin was by this means seen to consist of (1) large tablets of bismuth, deposited at 175°; (2) a mixture of these with fragments of tin, deposited at 125°; (3) a eutectic mixture of all three metals, deposited at 96°, which, under a low power, appears to be homogeneous, but is seen, when more highly magnified, to consist of distinct grains of its individual constituents. Alloys of copper, tin, and antimony contain the well-defined compounds $SnCu_3$ and $SbCu_2$ (*loc. cit.*), but what has been said with regard to mixtures of lead, tin, and bismuth, also applies to these alloys, assuming the latter to consist, not of copper, tin, and antimony, but of copper, $SnCu_3$, and $SbCu_2$.

Copper–tin–antimony, lead–copper–antimony, lead–tin–antimony, and zinc–tin–antimony alloys were also examined, and in no case was the formation of a ternary compound observed, only such compounds as are contained in binary alloys being found. In alloys of copper, tin, and antimony, for example, crystals of the compounds SbSn and $SnCu_3$ were noticed.

In ternary alloys, three successive deposits may, in general, be distinguished. The first is formed by a pure substance which may be either a metal or a compound; the second is a mixture of two substances, one of which is that first deposited; the third is a mixture of three substances which include the two previously deposited. The number of deposits may in certain cases be reduced to two, or even to one, in consequence of the formation of solid solutions. The nature of the successive deposits and their relative proportion depend on the chemical composition of the alloy; the size and distribution of the constituents, and, consequently, the physical and mechanical properties of the alloy, vary, however, with the rapidity of its solidification and other circumstances. N. L.

Constitution of Lead Salts in Aqueous Solutions. By H. FR. FERNAU (*Zeit. anorg. Chem.*, 1898, **17**, 327—354).—The interest which attaches to the behaviour of lead salts in aqueous solutions, in view of the use of these salts in accumulators, has led the author to submit solutions of lead chloride to cryoscopic and electrical investigation. The measurements carried out show that the molecule of lead chloride undergoes electrolytic dissociation in accordance with the equation

$$PbCl_2 = \overset{++}{Pb} + 2\overset{-}{Cl}$$

and also that in all probability hydrolysis occurs in very dilute solution. This last change may be probably represented by the equation

$$PbCl_2 + 2HOH = Pb^{OH}_{OH} + 2\overset{+}{H} + 2\overset{-}{Cl}.$$

H. C.

Some Halogen Salts of Lead. By VICTOR THOMAS (*Compt. rend.*, 1898, **126**, 1349—1352).—Lead chloriodide, PbICl, appears to be the sole product of the action of hydrochloric acid and alkali chlorides on lead iodide, and of alkali iodides on lead chloride. This salt is less soluble than either lead chloride or lead iodide, and may be separated therefrom by fractional crystallisation. It is converted by the action of nitric peroxide, even at the ordinary temperature, into lead oxychloride, Pb_2OCl_2, with elimination of iodine; lead iodide, under the same conditions, yields lead oxide, whilst the chloride and bromide are not affected. N. L.

Mixed Haloids and Halo-thiocyanates of Lead. By CHARLES H. HERTY and T. R. BOGGS (*J. Amer. Chem. Soc.*, 1897, **19**, 820—824. Compare Abstr., 1896, ii, 474).—An examination has been made of the crystals deposited from solutions containing two of the lead haloids or one of these salts, and lead thiocyanate, with the object of determining whether mixed crystals or a true compound were formed. Solutions were prepared containing the salts in different proportions, and were submitted to fractional crystallisation, each crop of crystals being examined.

Lead thiocyanate forms a compound with lead chloride and with lead bromide, but not with the iodide, the latter crystallising side by side with the thiocyanate from a mixed solution.

Lead chloride forms mixed crystals with all proportions of the isomorphous bromide, whilst the mixed crystals of chloride and iodide always contain an excess of the former. Similarly, the mixed crystals of bromide and iodide contain an excess of bromide. A. H.

Copper Alkali Thiosulphates. By ARTHUR ROSENHEIM and S. STEINHÄUSER (*Ber.*, 1898, **31**, 1876—1877. Compare Ch. and J. Bhaduri, this vol., ii, 428, and Muthmann and Stützel, this vol., ii, 513).—A preliminary notice. The following compounds have been prepared :— $Cu_2S_2O_3,K_2S_2O_3 + 1\frac{1}{2}H_2O$, yellow, crystalline; $Cu_2S_2O_3,2K_2S_2O_3 + 1\frac{1}{2}H_2O$, yellow prisms ; $Cu_2S_2O_3,2K_2S_2O_3$, white needles ; $Cu_2S_2O_3,(NH_4)_2S_2O_3 + 1\frac{1}{2}H_2O$, yellow prisms ; $Cu_2S_2O_3,2(NH_4)_2S_2O_3 + 1\frac{1}{2}H_2O$, white needles ; $Cu_2S_2O_3,2BaS_2O_3 + 4H_2O$, crystalline, white precipitate. Of these, the first two have been described already, but as containing different amounts of water of crystallisation ; the third is regarded by Muthmann and Stützel as $K_2S_2O_3,CuS_2O_3$. C. F. B.

Colloidal Mercury. By ALFRED LOTTERMOSER (*J. pr. Chem.*, 1898, [ii], **57**, 484—487).—Stannous oxide, prepared by boiling stannous chloride with sodium carbonate and a little water, and washing the precipitate, is dissolved in nitric acid. Into this solution of stannous nitrate, a solution of mercurous nitrate is poured, the mixture being stirred during the process; both solutions must be very dilute, and contain only enough free acid to prevent the precipitation of a basic salt; a not inconsiderable excess of stannous nitrate must be employed, otherwise the product is unstable. To the dark brown solution thus obtained, ammonium citrate is added, when the colour changes to black, and the coagulated mercury separates as a black precipitate. The liquid is cautiously neutralised with ammonia, and the precipitate is collected and dried over sulphuric acid under diminished pressure. It has a silvery lustre, and dissolves in water, giving a deep brown solution; when chlorine water is added gradually to this, a milky solution of colloidal mercurous chloride is obtained at first; finally, a clear solution of mercuric chloride. Bromine water acts in the same way. In the action of iodine solution, two stages cannot be recognised; a deep red liquid is obtained, which rapidly deposits mercuric iodide. C. F. B.

Reactions between Mercury and Concentrated Sulphuric Acid. By CHARLES BASKERVILLE and F. W. MILLER (*J. Amer. Chem. Soc.*, 1897, **19**, 873—877).—Sulphuric acid reacting with excess of mercury produces sulphurous anhydride and white, crystalline, mercurous sulphate. When a mixture containing excess of acid is heated at 100° for 20 hours, sulphurous anhydride and mercurous sulphate are obtained, and on heating at 150° for 2 hours, a mixture of mercurous and mercuric sulphates is produced, containing 50 per cent. of the former salt; as the temperature is raised, however, the amount of mercurous sulphate diminishes until, when mercury is added to the boiling acid, the product consists entirely of mercuric sulphate. When mercurous sulphate, or a mixture of this with mercuric sulphate, is heated with sulphuric acid, the amount of sulphurous anhydride evolved is proportional to the quantity of mercurous salt present. No indication could be obtained of the liberation of hydrogen during the initial stages of the reaction, and no sulphide or free sulphur was produced. The acid is directly reduced by the metal, and the authors find that this action takes place even at ordinary temperatures. G. T. M.

Valency of the Cerite Metals. By WILHELM MUTHMANN (*Ber.*, 1898, **31**, 1829—1836).—It is impossible to accept Wyrouboff's conclusion (*Bull. soc. franç. Min.*, **15**, 63), that cerium, lanthanum, didymium, and thorium must be bivalent because they form silicotungstates isomorphous with the calcium salt $12WO_3, SiO_2, 2CaO + 27H_2O$, and for other reasons; for, in the first place, the crystalline form of such complex salts is probably but little dependent on the relatively small amount of metallic oxide present; then Bodmann has shown (this vol., ii, 435) that neodymium nitrate forms mixed crystals with bismuth nitrate, from which the tervalency of the cerite metals may equally be inferred. Again, there is no reason, *à priori*, why the ignited oxide of a tervalent metal, such as lanthanum, should not combine with water, to form a slightly soluble hydroxide having an alkaline reaction; as regards absorption of carbonic anhydride, ignited lanthanum oxide no more does this at the ordinary temperature than calcium oxide does. And touching the solubility of the sulphates, anhydrous cerium sulphate is more soluble in cold water than even magnesium sulphate, The author has now found that the increase in the equivalent conductivity of lanthanum salts with increasing dilution of their aqueous solutions is in accordance with the tervalency of the metal, this increase, $\mu_{32}—\mu_{1024}$, being 28 and 26 for the nitrate and chloride, as compared with 20 and 18 for the corresponding salts of magnesium, whilst for the sulphate it is 47, the values for chromium and aluminium being 59 and 53 respectively.

Further, the molecular weight of cerium chloride, as determined by the boiling point method, in absolute alcoholic solution, is 232 ; $CeCl_3$ requires 246·5; $CeCl_2$, 164. It must, then, be admitted that the cerite metals are indeed tervalent. C. F. B.

Incandescent Gas Mantles of Commerce. By Ernest Hintz (*Zeit. anal. Chem.*, 1898, **37**, 504—524).—In continuation of earlier work on this subject (this vol., ii, 339), the author has investigated the influence of the addition to the standard mixture of 1 part of ceria and 99 parts of thoria, of quantities of zirconia, neodymia, lanthana, and yttria up to 20 per cent. Zirconia has no influence below 1 per cent., whilst above 1 per cent. it reduces the emissive power. The other earths have no effect up to 2 per cent., but above that limit all of them produce a diminution in the luminosity. Further experiments with different mixtures of thoria and ceria show that any variation in either direction from 1 per cent. of ceria results in diminished luminous effect. When the proportion of ceria does not exceed 1 per cent., and only small quantities of the other earths are present, the percentage of ceria may be approximately ascertained by photometric measurements. M. J. S.

Earths of the Yttria Group in Monazite Sand. By O. Boudouard (*Compt. rend.*, 1898, **126**, 1648—1651).—The author describes a series of fractionations of earths of the yttria group obtained from monazite sand, effected by fractional decomposition of the nitrates at 325°. Solutions of the sulphates of the earths showed a feeble absorption spectrum, consisting of bands at λ657—663, λ643—639, λ537, and λ524—522. The minimum value obtained for the atomic weight of the element contained in the fractions was 96·7, a number considerably higher than the atomic weight of yttrium. The bearing of the results obtained by the author and other observers on the possible existence of a new earth is briefly discussed.

N. L.

Chemistry of Didymium. By Louis M. Dennis and Emile M. Chamot (*J. Amer. Chem. Soc.*, 1897, **19**, 799—809).—The separation of neodymium from praseodymium by Welsbach's method can be most effectively and rapidly carried out in the presence of lanthanum salts by the slow crystallisation of the fractions. In the absence of lanthanum, crystallisation takes place much more slowly and the separation effected is also much less complete. The saturated solutions of the double ammonium nitrates were therefore allowed to crystallise spontaneously, the mother liquor being poured off and treated in the same way, whilst the crystals were redissolved and again allowed to crystallise out spontaneously, fractions giving a similar spectroscopic appearance being united, irrespective of their position in the series of fractionations. Lanthanum nitrate is added as the neodymium end of the series is approached.

The authors have obtained fractions in which certain of the bands show greatly increased intensity, and consider that the occurrence of these indicates the compound nature of the two constituents of didymium. A. H.

Action of Nitric Acid on Aluminium. By THOMAS B. STILLMAN (*J. Amer. Chem. Soc.*, 1897, **19**, 711—716).—It is generally stated that nitric acid, whether strong or dilute, is without action on aluminium, but Lunge and Schmidt (*Zeit. angw. Chem*, 1892, 7) found that the metal is readily attacked at ordinary temperatures by nitric acid of sp. gr. 1·20, and that the action diminishes as the concentration of the acid increases; the author's experiments confirm these observations. Coarse turnings containing 99·6 per cent. of aluminium, and nitric acid of three strengths (sp. gr. = 1·15, 1·35, and 1·46) were employed, and in each case 1 gram of the metal was placed in 100 c.c. of acid. The metal completely dissolved at 100°, the time required varying from 20 minutes to 2 hours; after 7 days immersion in the weakest acid at 20°, about 94 per cent. of the sample had dissolved, whilst in the strongest acid under these conditions, only 12 per cent. had passed into solution.

From the solutions thus obtained, aluminium nitrate having the composition $Al_2(NO_3)_6 + 18H_2O$ separates in colourless, rhombic octahedral crystals. G. T. M.

Reduction of Permanganic Acid by Manganese Dioxide. By HARMON N. MORSE and CHARLES L. REESE (*Amer. Chem. J.*, 1898, **20**, 521—535).—From the fact that no oxygen is evolved when hydrogen is left in contact with a neutral solution of potassium permanganate (compare Meyer and von Recklinghausen, Abstr., 1897, ii, 19), whereas it is rapidly generated when sulphuric acid is present, Hirtz and Meyer (Abstr., 1897, ii, 93) concluded that its production in the latter case could not be attributed to the reducing action on the permanganate of precipitated manganese dioxide (compare Morse, Hopkins, and Walker, Abstr., 1896, ii, 475; and Morse, Abstr., 1897, ii, 145). In support of this view, they adduced the fact that only 12·5 per cent. of the volume of oxygen obtained when hydrogen is present is liberated, in the same time, from an acidified 5 per cent. solution of potassium permanganate by the manganese dioxide precipitated by the hydrogen.

In the author's opinion, this experiment proves only that the oxygen is evolved much more rapidly during the absorption of the hydrogen than is subsequently the case when the precipitated manganese dioxide interacts with the permanganic acid. They suggest, provisionally, that this is due to the manganese dioxide molecules, initially precipitated by a gaseous reducing agent, being of a greater simplicity, and hence capable of more rapid action, than those produced by a solid such as manganous sulphate. From the experiments which follow, they are also led to discredit Hirtz and Meyer's view (*loc. cit.*), that the liberation of oxygen from potassium permanganate by manganese dioxide and by hydrogen or carbonic oxide are phenomena of different orders.

Three solutions, A, B, and C, were employed, containing respectively 2·822, 5·644, and 51 milligrams of potassium permanganate per c.c.; each solution was carefully freed from precipitated manganese dioxide before use. The first two of these did not lose any measurable quantity of oxygen when agitated, either neutral or strongly acid, in contact with air in sealed tubes, during 150—300 hours. The third solution, C, however, which, while neutral or only slightly acid, was not decomposed at all under these conditions, liberated from 1·9 to 3·6 c.c. of oxygen when acidified with an amount of dilute sulphuric acid equivalent to three times the potassium of the salt. Since this solution was much more stable than Meyer and Recklinghausen's 5 per cent. solution, the authors conclude that the latter contained manganese dioxide, precipitated either by the addition of *concentrated* sulphuric acid, or by the subsequent heating to which it was subjected.

Experiments made to determine the relative rates of reduction when equal volumes of permanganic acid are agitated, on the one hand, with a certain volume of hydrogen, and, on the other, with a quantity of manganese dioxide, precipitated by manganous sulphate, equivalent to the latter, show: (1) That in the case of the solutions B and C, the oxide precipitated by hydrogen is by far the more active one, during the first 24 hours; in the case of solution A, the hydrogen was not completely absorbed in this time. (2) That the maximum rapidity of action of the hydrogen as an oxygen liberator occurs when the concentrated solution C is acidified with 3 mols. of sulphuric acid; 19·88 c.c. of oxygen were evolved in 24 hours, whilst from the precipitated manganese dioxide, in the same time, only 2·5 c.c. were obtained. This confirms Hirtz and Meyer's crucial experiment. (3) That in the period from the 24th to the 150th hour, the oxide produced by hydrogen acts much less rapidly in solution C than that produced by manganous sulphate. In the case of B, and possibly of A, the order of activity is reversed; but with all three solutions between the 150th and 300th or 600th hour, the oxide from the hydrogen is much the less active. (4) That assuming the liberation of oxygen by hydrogen to be due to precipitated manganese dioxide, the evidence appears to show that this action is continuous, and without any such limit as was thought to exist by Meyer and von Recklinghausen. W. A. D.

[NOTE BY ABSTRACTOR.—In the original paper, the authors have apparently misinterpreted (p. 522) Hirtz and Meyer's objection to the hypothesis that manganese dioxide is the cause of the liberation of oxygen during the hydrogen absorption. Its point appears to be, that when neutral potassium permanganate is employed, no oxygen is evolved, although here, as well as with acid solutions, manganese dioxide is precipitated.]

Vaporisation of Iron at the Ordinary Temperature. By HENRI PELLAT (*Compt. rend.*, 1898, **126**, 1338. Compare Abstr., 1896, ii, 601).—The action of iron on a photographic plate in the dark must be attributed to vaporisation of the iron, and not to radiations emitted by it, since the phenomenon does not occur when the metal is separated from the plate by a thin sheet of glass. N. L.

Minute Structure of Alloys of Iron and Nickel. By FLORIS OSMOND (*Compt. rend.*, 1898, 126, 1352—1354).—The study of the minute structure of alloys of iron and nickel confirms the classification based upon mechanical properties and the analogy between this series of alloys and the various carbon and manganese steels. Three distinct groups may be recognised: (1) Alloys containing up to about 8 per cent. of nickel; structure resembling that of ordinary steel, except that the grains of iron are smaller and show a less tendency to increase in size at high temperatures. (2) Alloys containing from 12 to 25 per cent. of nickel; structure fibrous, like that of tempered carbon steels. (3) Alloys containing from 25 to 50 per cent. of nickel; structure purely crystalline. N. L.

Influence of Heat Treatment, and of Carbon, on the Solubility of Phosphorus in Steel. By EDWARD D. CAMPBELL and S. C. BABCOCK (*J. Amer. Chem. Soc.*, 1897, **19**, 786—790. Compare Abstr., 1897, ii, 101).—Experiments similar to those previously described have been made with an accurate pyrometer, so that the exact temperatures employed are known. The percentage of phosphorus soluble in a slightly acid solution of mercuric chloride was estimated in samples, containing various amounts of carbon, which were submitted to different heat treatment. The results confirm the conclusion that phosphorus, like carbon, is capable of existing in steel in at least two forms, and that the influence of phosphorus on the physical properties of steel is as much dependent on the form of combination as on the quantity present. A. H.

Condition of Silicon and Chromium in Irons and Steels. By ADOLPHE CARNOT and GOUTAL (*Compt. rend.*, 1898, **126**, 1240—1245). Ferrosilicons poor in manganese contain a silicide, $SiFe_2$, which is magnetic, and can be isolated by dissolving the metal in very dilute sulphuric acid and treating the residue successively with potassium hydroxide solution and dilute sulphuric acid. It is identical in composition with the silicide obtained by Moissan in the electric furnace, but differs from it in being readily attacked by hot dilute acids.

Silico-spiegels containing 20 per cent. of manganese contain a double silicide, $Si(Fe\!:\!Mn)_3$. Ferromanganeses contain the silicide SiF_2, which also exists in the ferrosilicons poor in manganese.

Ferrochromiums, when treated with hydrochloric acid at 60°, the residue being afterwards fused with potassium hydrogen sulphate, yield an insoluble residue of the iron chromium carbide, $CFe_3,3C_2Cr_3$.

Chrome steels contain the carbide, $3CFe_3,Cr_2C_3$, which can be isolated by treatment with very dilute (7:100) hydrochloric acid, and the same carbide was also isolated from a ferromanganese containing a small quantity of chromium by treating it with cupric potassium chloride solution (compare Abstr., 1897, ii, 555). C. H. B.

Hydrolysis of Ferric Chloride. By WALTHÈRE SPRING (*Rec. Trav. Chim.*, 1897, **16**, 237—249. Compare Krecke, *J. prakt. Chem.*, 1871, [ii], **3**, 286; Wiedemann, *ibid.*, 1874, [ii], **9**, 145; Antony and Giglio, Abstr., 1896, ii, 250, and Goodwin, Abstr., 1897, ii, 16).—In opposition to former views, it is stated that ferric chloride, when in solution, undergoes exactly the same dissociation as when heated. It is first converted into ferrous chloride and chlorine, the latter then reacts with the water, yielding hydrogen chloride and oxygen, the oxygen combines with the ferrous chloride, yielding an oxychloride, Fe_2Cl_4O, which, with the water and hydrochloric acid, forms a state of equilibrium varying with the temperature.

Most of the author's experiments were restricted to concentrated solutions. When solid potassium ferricyanide and resublimed ferric chloride are ground together, no reaction takes place ; the same is true if a very concentrated solution (230 in 100) of ferric chloride is used. More dilute solutions (below 126 in 100) give an immediate precipitate of Prussian blue and chlorine is evolved ; with still more dilute solutions (5 or 10 in 100) a brown coloration is developed, and finally a blue precipitate is formed. It is not possible to fix a limit of dilution at which the blue precipitate is not immediately formed ; in fact, a mixture which at ordinary atmospheric pressure gives no immediate precipitate, gives the blue precipitate on the surface when placed under reduced pressure. It has also been found that solutions of ferric chloride of different strengths, after being charged with chlorine, yield no precipitate with potassium ferricyanide, unless they are placed under reduced pressure.

Ferric bromide reacts in much the same manner, but since it is more readily dissociated, more concentrated solutions react with potassium ferricyanide, yielding the blue precipitate and evolving bromine. Ferric nitrate, on the other hand, reacts much more slowly.

Reference is also made to ferric and ferrous iodides.

If air is drawn through concentrated solutions of ferric chloride, hydrogen chloride, and not chlorine, is evolved ; dilute solutions yield neither. Saturated solutions of ferric chloride have very little action on metallic iron, less concentrated solutions readily dissolve the metal, and it has been found that the metal is most readily dissolved by those solutions which give an immediate blue precipitate when treated with potassium ferricyanide. In solutions the concentration of which is less than 80 in 100, evolution of hydrogen always accompanies dissolution of the metal. The facts are in accord with the theory of hydrolysis stated above.

The hydrolysis is to be compared to ionisation, the ferrous chloride becoming cathion and the chlorine anion. A difference of potential can be shown to exist between the two. J. J. S.

Ferric Phosphate. By Robert M. Caven (*J. Soc. Chem. Ind.*, 1896, 15, 17—19 and 70).—On gradually adding a neutral solution of ferric chloride to a solution of ammonium phosphate, a precipitate is at first formed, which subsequently redissolves, giving a clear solution when the quantity of ferric chloride necessary to form ferric phosphate has been added. In presence of ammonium acetate and a few drops of acetic acid, however, a precipitate of ferric phosphate is obtained. The latter is best prepared by adding ferric chloride to twice the theoretical amount of phosphoric acid dissolved in water ; on washing the precipitate with hot water, slight hydrolysis appears to take place, with the formation of phosphoric acid and ferric hydroxide. Fresenius has stated that the estimation of phosphoric acid as ferric phosphate is inaccurate, owing to the latter being slightly soluble in water; in the author's opinion, the salt is insoluble in water, but loses phosphoric acid when washed in the manner above stated. By long-continued boiling with an excess of aqueous ammonia, ferric phosphate is completely converted into ferric hydroxide and ammonium phosphate; the reverse change, however, takes place when freshly precipitated ferric hydroxide is boiled with aqueous ammonium phosphate, ammonia being evolved and ferric phosphate formed.

On digesting an excess of ferric phosphate with cold, dilute hydrochloric acid, and filtering, a solution is obtained which is almost colourless. It appears to contain free hydrochloric acid and dissolved ferric phosphate; double decomposition, however, seems to occur on adding concentrated hydrochloric acid, as a yellow coloration is immediately produced. W. A. D.

Preparation of Cobalt-ammonia Salts. By Sofus M. Jörgensen (*Zeit. anorg. Chem.*, 1898, **17**, 455—479).—The paper contains details of the methods of preparation and of identification employed by the author. It is chiefly a *résumé* of the work previously published by the author and others. E. C. R.

Colour Changes in Solutions of Chromium Salts. By Francis P. Venable and F. W. Miller (*J. Amer. Chem. Soc.*, 1898, **20**, 484—497).—It is well known that solutions of certain chromium salts which are violet in colour become green on heating. A reverse action takes place on standing, the solutions regaining their green colour; some salts, however, require a much longer time than others for this change to become complete. The authors consider that the most likely explanation of these changes is that brought forward by Berzelius (*Ann. phys. Chem.*, **61**, 1), and which presupposes the formation of basic chromium salts (compare Dougal, *Trans.*, 1896, 1526).

When alcohol is added to the violet solution of chrome alum, fine violet crystals of the composition $K_2SO_4,Cr_2(SO_4)_3 + 12H_2O$ are obtained; but from a solution of the alum rendered green by heating, alcohol precipitates a green mass of the composition

$$7K_2SO_4,5Cr_2(SO_4)_3,Cr_2(OH)_6 + 4H_2O,$$

and from the green solution of chromium sulphate, salts, probably of the formulæ $Cr_2(SO_4)_3,Cr_2(OH)_6 + 15H_2O$ and $2Cr_2(SO_4)_3,Cr_2(OH)_6 + 20H_2O$, are thrown down. A. W. C.

Action of some Carbonates on Chromous Acetate. By Georges Baugé (*Compt. rend.*, 1898, **126**, 1566—1569).—When chromous acetate is treated with a 20 per cent. solution of potassium carbonate, the compound $(K_2CO_3,CrCO_3)_2 + 3H_2O$ is obtained in small, yellow, hexagonal prisms, which at first dissolve in water, but gradually polymerise, whether in solution or in the solid state, and become less soluble. It is a powerful reducing agent, and decomposes water below 100°; when heated out of contact with air, it becomes brown, but regains its original colour on cooling; at about 280°, it decomposes. When heated in air, it is converted into potassium chromate.

If the yellow double carbonate is placed in water and treated with a current of carbonic anhydride, or if the chromous acetate is treated with a dilute solution of potassium carbonate, a less soluble, red double carbonate is formed, but was not analysed; it is partially decomposed by water, and decomposes water at 100°.

Magnesium hydrogen carbonate converts the chromous acetate into a red-brown compound, which decomposes water at 100°; but could not be obtained free from magnesium carbonate precipitated at the same time. The carbonates of barium, calcium, and strontium have no action on chromous acetate. C. H. B.

Blue Glass containing Chromic Oxide as a Basic Constituent. By André Duboin (*Ber.*, 1898, **31**, 1977—1979).—The blue colour of the sapphire is due to chromium, and can be reproduced by fusing the necessary mixture in a reducing flame. Blue glass containing chromium can readily be prepared by fusing many mixtures of silica, alumina, lime, &c., with potassium chromate in a crucible lined with carbon. The best results are obtained with mixtures containing baryta or boric acid. Calcium carbide can be used as a reducing agent, whereas aluminium does not yield good results. Ordinary glass only gives a product which is violet-blue in the immediate neighbourhood of the layer of carbon. A. H.

The Lowest State of Oxidation of Molybdenum. By Wilhelm Muthmann and Wilhelm Nagel (*Ber.*, 1898, **21**, 2009—2014).—The authors confirm Blomstrand's view as to the complex nature of the so-called dichloride and dibromide of molybdenum. The formation of the hydroxides, $Mo_3Cl_4(OH)_2$ and $Mo_3Br_4(OH)_2$, the existence of salts such as $Mo_3Cl_4Br_2$ and $Mo_3Cl_4CrO_4$, and the great stability of the radicles, Mo_3Cl_4 and Mo_3Br_4, towards alkalis and silver nitrate led Blomstrand to conclude that the above haloids had the formulæ $Mo_3Cl_4Cl_2$ and $Mo_3Br_4Br_2$, and he called them chloromolybdenum chloride and bromomolybdenum bromide respectively.

A determination of the molecular weight of the chloride in alcoholic solution indicates that its formula is Mo_3Cl_6. An alcoholic solution of the chloride, when electrolysed, yields hydrogen and the hydroxide, $Mo_3Cl_4(OH)_2$, at the cathode, whilst aldehyde and ethylic chloride are formed at the anode. When a solution of the salt, $Mo_3Br_4(ONa)_2$, is electrolysed, the free hydroxide, $Mo_3Br_4(OH)_2$, is produced at the anode, and hydrogen is liberated at the cathode.

On warming the alkaline solution of the chloride or the bromide, a black precipitate is produced, which Blomstrand at first supposed to be the hydrated monoxide, and to which he afterwards gave the formula $Mo_3(OH)_6$. The authors find that hydrogen is evolved in this reaction and that the precipitate really consists of the hydrated sesquioxide, $Mo(OH)_3$. From this, it follows that there is no longer any evidence for the existence of the monoxide or of compounds containing bivalent molybdenum. G. T. M.

Ozomolybdates [Permolybdates]. By Wilhelm Muthmann and Wilhelm Nagel (*Ber.*, 1898, **31**, 1836—1844. Compare this vol., ii, 432).—In the molybdates of the alkali metals it is possible, by digestion with hydrogen peroxide solution, to add on oxygen to the extent of one atom of oxygen, or *less*, per atom of molybdenum, but the compounds formed are not to be regarded as the salts of permolybdic acid, properly so called; they lose oxygen readily, reducing potassium permanganate and silver oxide, with evolution of oxygen, and it must be supposed that the apparent addition of an atom of oxygen consists really in the replacement of one atom of oxygen by two linked to one another as in hydrogen peroxide or ozone, for which reason the compounds are named *ozomolybdates.*

Ozomolybdic acid, $H_2MoO_5 + xH_2O$ $[x = 1\frac{1}{2}\,?]$, was obtained by digesting molybdic anhydride with 25 per cent. hydrogen peroxide solution, finally on the water bath, filtering, and concentrating the filtrate under diminished pressure. It is orange-red and amorphous; besides reducing permanganate, silver oxide, and hypochlorites, it liberates the halogens from their compounds with hydrogen. The ozomolybdates were obtained by dissolving molybdates in hydrogen peroxide solution, usually of 25 per cent. strength, with the aid of heat; frequently one compound separated first, and then another; these are described in the order in which they separated. Evidence was obtained of the existence of other ozomolybdates, in addition to those described, but it was impossible to isolate them.

Rubidium ozomolybdates.—From $Rb_2O,3MoO_3$: (1) $3Rb_2O,10MoO_4 + 14H_2O$, yellowish-red and amorphous; (2) $Rb_2O,2MoO_3,MoO_4 + 3H_2O$, yellow, monoclinic crystals. From $3Rb_2O,7MoO_3 + 4H_2O$ and 5 per cent. hydrogen peroxide: (1) $Rb_2O,2MoO_3,MoO_4 + 3H_2O$ (see above); (2) $3Rb_2O,5MoO_3,2MoO_4 + 6H_2O$, monoclinic crystals; in one case, when a very dilute solution was prepared, yellow, monoclinic tables of $Rb_2O,3MoO_3,MoO_4 + 4H_2O$ separated.

Rubidium trimolybdate, $Rb_2O,3MoO_3$, obtained by fusing Rb_2CO_3 with $3MoO_3$, was once obtained crystallised with $1H_2O$.

Cæsium ozomolybdates.—From $Cs_2O,4MoO_3$: (1) $Cs_2O,4MoO_4 + 6H_2O$, orange-red, amorphous; (2) $3Cs_2O,7MoO_3,3MoO_4 + 4H_2O$, yellow, crystalline.

Cæsium tetramolybdate, $Cs_2O,4MoO_3$, and not a trimolybdate, is obtained by fusing $CsCO_3$ with $3MoO_3$, and washing the fused mass with water; it crystallises from water with $2H_2O$.

The compound, K_2O_2,MoO_4,H_2O_2, described by Melikoff and Pissarjewsky (this vol., ii, 337), was probably not a definite chemical compound. It may be regarded as certain, however, that at low temperatures molybdates can take up *more* than one atom of oxygen for each atom of molybdenum contained in them. C. F. B.

A New Carbide of Tungsten. By P. WILLIAMS (*Compt. rend.*, 1898, **126**, 1722—1724).—When a mixture of tungstic anhydride and carbon is heated in the electric furnace, the carbide, W_2C, described by Moissan is produced. In presence of a large excess of iron, however, combination occurs at a somewhat lower temperature, and a compound having the composition WC is obtained. This carbide is an iron-grey powder, consisting of microscopic, cubical crystals, which are harder than quartz and have a sp. gr. = 15·7 at 18°. When strongly heated in a closed vessel, it melts and decomposes into graphite and the carbide W_2C, whilst in presence of air or oxygen it slowly oxidises, with formation of tungstic and carbonic anhydrides. It is attacked by fluorine in the cold with incandescence, but is not acted on by chlorine, bromine, iodine, and the halogen acids. Sulphuric and nitric acids have but little action on the carbide, but it is readily oxidised by heating with potassium chlorate or nitrate. N. L.

Solubility of Stannous Iodide in Water and in Solutions of Hydriodic Acid. By STEWART W. YOUNG (*J. Amer. Chem. Soc.*, 1897, **19**, 845—851).—The solubility of stannous iodide in water increases as the temperature rises. In hydriodic acid solutions containing 3 to 8 per cent. of acid, the solubility is less than in water, increasing with the temperature and diminishing with the concentration of the acid. With solutions of 9 to 15 per cent., the solubility is still less than in water, and increases with the temperature, but it now also increases with the concentration. When the solutions contain 25 per cent. and upwards, the solubility is greater than in water, and as the temperature rises the solubility at first diminishes until a point of minimum solubility is reached lying between 30° and 40°; beyond this, the solubility again increases. G. T. M.

Iodostannous Acid. By STEWART W. YOUNG (*J. Amer. Chem. Soc.*, 1897, **19**, 851—859. Compare previous abstract).—A saturated solution of stannous iodide in hydriodic acid of 25 per cent. and upwards when cooled by ice cold water, deposits pale yellow needles quite different in appearance from the red needles of stannous iodide. This yellow substance readily decomposes, giving the red iodide, and is so unstable that its composition could only be obtained by indirect methods. By determining the amounts of hydrogen and stannous iodides in solution before and after the separation of the yellow solid, this is shown to be an *iodostannous acid* having the formula $HSnI_3$.

Hydriodic acid of known strength was taken, and an amount of stannous iodide more than sufficient to saturate the liquid added to it, and finally the amount of stannous iodide dissolved was estimated by titration.

From 0° to 15° the solubility in hydriodic acid of 39·6 per cent. strength increases; and from 15 to 20° it still increases, but much more slowly; on allowing the mixture to remain for some hours at 20°, the undissolved yellow iodostannous acid changes to red stannous iodide, and this change is accompanied by a marked decrease in solubility; from 20° to 30°, the solubility diminishes gradually, and from 30° upwards it increases regularly. With a similar solution in 30 per cent. acid, the rapid decomposition of iodostannous acid occurs at 1·5°, and in this case the change is accompanied by an increase in solubility. When in contact with stronger hydriodic acid, the iodostannous acid is stable at higher temperatures. The peculiarities observed in the curves of solubility are due to the gradual decomposition of solid and dissolved iodostannous acid over a considerable range of temperature.

G. T. M.

Atomic Weight of Zirconium. By FRANCIS P. VENABLE (*J. Amer. Chem. Soc.*, 1898, **20**, 119—128).—To prepare the material used in his determinations, the author fused pulverised zircon in a nickel crucible with a mixture of sodium hydroxide and fluoride; after dissolving in hydrochloric acid, and attempting to remove the silica by evaporating to dryness, it was found that the latter was retained by the zirconium chloride, even after several crystallisations from boiling concentrated hydrochloric acid. The chloride was therefore ignited, and the powdered zirconia strongly heated several times with hydrofluoric acid; the product was fused with potash, dissolved in hydrochloric acid, and the chloride formed crystallised twenty or thirty times from boiling hydrochloric acid. The crystals thus obtained were introduced, in quantities of 1 to 5 grams, into small glass flasks of known weight, and dried at 100° in a stream of hydrogen chloride; on attaining a constant weight, the product consisted of a white powder having the composition $ZrOCl_2 + 3H_2O$. It was dissolved in a small quantity of water, transferred to a platinum crucible, the solution evaporated, and the residue gradually heated during 3 or 4 days until the whole of the chlorine was evolved. The values of the atomic weight of zirconium, obtained by comparing the weight of zirconia thus produced with the weight of the oxychloride taken, range from 90·61 to 91·12; the mean of 10 experiments is 90·78 ($O = 16$), which compares well with the value 90·65 given by Bailey.

The main sources of error in the method are the deliquescence of the oxychloride; the loss of finely-divided zirconia during ignition; the corrosion of the platinum crucibles; the action of the gaseous and liquid hydrochloric acid on the glass vessels; and substances carried into the drying flasks by the stream of hydrogen chloride. The author purposes repeating the work under conditions which will minimise these errors. W. A. D.

Zirconium Oxyhaloids. By FRANCIS P. VENABLE and CHARLES BASKERVILLE ((*J. Amer. Chem. Soc.*, 1898, **20**, 321—329).—*Zirconium oxychloride*, $ZrOCl_2 + 8H_2O$, is obtained when a solution of zirconium hydroxide in hydrochloric acid is evaporated; large crystals are obtained when the solution is evaporated over sulphuric acid; these crystals lose water when exposed to the atmosphere. When heated to 135—140°, a large amount of chlorine is driven off, but yet not the whole of the water. When heated at 100° in a current of hydrogen chloride, the crystals lose $5H_2O$ (compare Paijkull, this Journ., 1873, 1105, and Melliss, *Zeit. Chem.*, 1870, [ii], **6**, 196). A second form of the oxychloride may be obtained by crystallising from concentrated hydrochloric acid and then drying the crystals at 100—125° in an atmosphere of hydrogen chloride (compare Linnemann, Abstr., 1885, 1042, and Bailey, *Chem. News*, 1891, **60**, 17); the composition of the dried crystals is represented by the formula $ZrOCl_2 + 3H_2O$. A third oxychloride, insoluble in hydrochloric acid, but readily soluble in water, is obtained by precipitating an aqueous solution with hydrochloric acid. Its composition is $ZrOCl_2 + 6H_2O$, although Paijkull represented it as $2ZrOCl_2 + 13H_2O$.

An oxybromide, $ZrOBr_2 + 8H_2O$, has been previously described by Weibull (Abstr., 1887, 778). The authors find that the oxybromides belong to two types with varying degrees of hydration, namely,

$ZrOBr_2 + xH_2O$, where $x = 3$, 13, or 14, and $ZrBr(OH)_3 + yH_2O$, where $y = 1$ or 2. All these compounds are deliquescent, and decompose on exposure to moist air, the clear, white crystals often coloured pink by the presence of free bromine, melting to a gum, frequently with the evolution of hydrogen bromide. The salts are unstable even in dry air, as was shown by exposing the crystals in a desiccator over sulphuric acid, when much hydrogen bromide was evolved. The crystals may be prepared in two ways: either by dissolving pure zirconium hydroxide in dilute hydrobromic acid and evaporating, with subsequent additions of 48 per cent. hydrobromic acid and repeated evaporation, or by saturating a concentrated solution of hydrogen bromide with zirconium hydroxide and evaporating.

Hinsberg (Abstr., 1887, 896) has described an oxyiodide, $ZrI(OH)_3 + 3H_2O$. According to Melliss, an oxyiodide is not formed by dissolving the hydroxide in hydriodic acid, but the authors state that zirconium hydroxide, when precipitated cold, is soluble to a slight extent in strong, aqueous hydriodic acid; needles may be obtained on evaporation, but these are always contaminated with free iodine. When the hydroxide is treated with hydrogen iodide, a hard, horn-like, coloured mass is obtained which is insoluble in water or acids. J. J. S.

Zirconium Dioxide. By FRANCIS P. VENABLE and A. W. BELDEN (*J. Amer. Chem. Soc.*, 1898, **20**, 273—276).—Carefully purified zirconium dioxide has a sp. gr. = 5·489, and after being strongly ignited is practically insoluble in all acids except hydrofluoric, in which it readily dissolves on heating; sodium zirconate, however, does not dissolve in hydrofluoric acid, probably owing to the formation of sodium zirconofluoride. Dilute sulphuric acid (sp. gr. = 1·56), when heated with powdered zirconia according to Berzelius's method, dissolves only 0·672 per cent. of its weight of the oxide. Contrary to Berzelius's statement, zirconia is not changed by prolonged heating with sodium carbonate; when strongly heated with microcosmic salt or with borax, it does not enter into fusion.

When the precipitate obtained by adding ammonia to a solution of a zirconium salt is pressed between filter papers and washed with light petroleum until a constant weight is attained, it approximates in composition to the hydroxide $Zr(OH)_4$; when alcohol and ether are used in the washing, there appears to be no definite limit to the removal of water. Bruch's statement (*Jahresb.*, 1854, 729), that zirconium hydroxide is slightly soluble in water and has an alkaline reaction, is incorrect; the latter was probably due to the ammonia which zirconium hydroxide persistently retains. The hydroxide precipitated from a cold solution of a zirconium salt is easily soluble in either dilute or concentrated mineral acids, with the exception of hydriodic acid; in oxalic acid, it readily dissolves, but is only sparingly soluble in glacial acetic acid and saturated solutions of tartaric or citric acid; in saturated solutions of ammonium carbonate and ammonium tartrate, it is soluble to the extent of about 1 per cent. When precipitated from a hot solution, zirconium hydroxide dissolves much less readily in dilute mineral acids than when precipitated in the cold.

Basic carbonates, of widely varying composition, appear to be formed on passing carbonic anhydride over moist zirconium hydroxide.
W. A. D.

Compounds of Tervalent Vanadium. By JAMES LOCKE and GASTON H. EDWARDS (*Amer. Chem. J.*, 1898, **20**, 594—606).—Vanadium trichloride appears to unite with potassium chloride to form a green, crystalline *double* salt, $KVCl_4$; it is doubtful, however, if this substance was obtained pure, since ferric chloride forms double salts of the type $2KCl,FeCl_3 + H_2O$.

Vanadium tribromide, $VBr_3 + 6H_2O$, prepared by dissolving vanadium hydroxide in pure, concentrated hydrobromic acid, is more unstable and crystallises less readily than the corresponding chloride.

Potassium vanadiocyanide, $K_3VC_6N_6$, prepared by adding an excess of potassium cyanide to an aqueous solution of vanadium chloride, and subsequently precipitating with alcohol, separates in bright scarlet, monosymmetric crystals, which are probably isomorphous with the corresponding derivatives of chromium, manganese, iron, cobalt, rhodium, and iridium; it is readily soluble in water, but is slowly decomposed by it, and immediately by mineral acids, hydrogen cyanide being evolved. The corresponding ammonium and sodium derivatives appear to exist only in solution. It is pointed out that the tendency of the metals, vanadium, chromium, manganese, iron, and cobalt, to form complex substances of the type $K_3MC_6N_6$, in preference to simple salts, diminishes as their atomic weight decreases.

Potassium vanadiothiocyanate, $K_3V(CNS)_6 + 4H_2O$, prepared by adding a concentrated aqueous solution of vanadium chloride to somewhat more than the calculated quantity of alcoholic potassium thiocyanate, separates in very dark red crystals, and corresponds with the chromium salt, $K_3Cr(CNS)_6 + 6H_2O$; its aqueous solution rapidly decomposes, but is stable in presence of an excess of potassium thiocyanate, and only very slowly undergoes oxidation; alkalis precipitate vanadium hydroxide from the solution only on boiling, but acids cause immediate decomposition.

In order to avoid oxidation, all the compounds described were prepared in an atmosphere of hydrogen; a description is given of the apparatus employed.
W. A. D.

Bismuth Suboxide. By LUDWIG VANINO and F. TREUBERT (*Ber.*, 1898, **31**, 2267—2272. Compare this vol., i, 435).—The authors show that this oxide is never formed by the action of stannous chloride on bismuth chloride in alkaline solutions. If the bismuth chloride is in excess, the precipitate consists of a mixture of metallic bismuth with metahydroxide or oxychloride. Three molecular proportions of stannous chloride suffice to completely reduce bismuth oxide, Bi_2O_3, to metallic bismuth. The behaviour of stannous chloride towards salts of bismuth is quite analogous to that of reducing agents such as hypophosphorous and hyposulphurous acids and formaldehyde, which also yield the metal, and not the suboxide.
G. T. M.

Hydrolytic Decomposition of Bismuth Nitrate. By UBALDO ANTONY and GUIDO GIGLI (*Gazzetta*, 1898, **28**, i, 245—249).—On treating bismuth nitrate with varying quantities of water, the quantity of bismuth going into solution decreases as the dilution increases, and a stage of dilution is at length reached when a precipitate of hydrate of bismuth containing no nitrate is thrown down, and the solution no longer contains any bismuth ; at this stage, 1 part of bismuth nitrate is in contact with 50,000 parts of water. The authors have previously shown (Abstr., 1896, ii, 604) that when 1 mol. of ferric nitrate is in contact with 19,280,000 mols. of water, no iron remains in solution, and the present experiments show that no bismuth remains in solution if 1 mol. of bismuth nitrate is in contact with 19,605,000 mols. of water ; the amounts of water required to effect this complete decomposition are in the ratio of 1 : 0·98 for the bismuth and ferric salts respectively, a result agreeing with the ordinary view, that the energy of an acid is independent of the nature of the associated base. W. J. P.

Purple of Cassius. By Richard Zsigmondy (*Annalen*, 1898, **301**, 361—387).—The author describes experiments which afford fresh evidence in favour of Schneider's view regarding the soluble form of gold purple (Abstr., 1893, ii, 575). Contrary to this investigator, however, he does not regard the hydrosol of stannic acid as essential to the existence of the hydrosol of gold, it having been shown that a solution of gold is stable if it contains only a small proportion of acids or salts (this vol., ii, 522). Gold purple of required composition and shade may be obtained by mixing solutions of colloidal gold and colloidal stannic acid, and adding dilute acids or salt solutions.

An important outcome of the investigation is the recognition of the fact that a mixture of colloidal substances is capable of behaving like a chemical compound, the properties of either constituent of such a mixture being masked by those of the other.

From a mixture of the hydrosols of stannic acid and silver, dilute sulphuric acid precipitates a reddish-yellow substance ; this dissolves in ammonia, and is also formed when silver nitrate is reduced in presence of stannic acid. M. O. F.

Occlusion of Oxygen and Hydrogen by Platinum Black. By Ludwig Mond, William Ramsay, and John Shields (*Proc. Roy. Soc.*, 1897, **62**, 50—52. Compare Abstr., 1895, ii, 492).—Platinum black was saturated with hydrogen, heated at 184° under reduced pressure, then placed in an ice calorimeter and allowed to reabsorb the gas ; it was found that 68·8 Cal. were developed per gram of hydrogen occluded. It is shown that the arguments put forward by Berthelot in favour of the existence of the compounds $Pt_{30}H_2$ and $Pt_{30}H_3$ are not justified, and that the difference observed by Favre between the behaviour of palladium and platinum towards hydrogen was merely due to the presence of oxygen in the platinum black.

Attempts made to remove oxygen from platinum black, with a view to the determination of its heat of occlusion, showed that reducing agents, whilst eliminating the oxygen from the substance, were themselves occluded and obstinately retained. It was also found that hydrogen, admitted to platinum black, does not remove all the oxygen, but only replaces that first removed, both gases being therefore occluded simultaneously.

Platinum black, saturated with hydrogen, was exhausted at 184°, and then allowed to come into contact with small quantities of oxygen. It was found that, after a certain point, the addition of more oxygen caused the pressure to increase; a further small quantity of gas was absorbed, however, on adding oxygen up to atmospheric pressure, and the heat simultaneously developed represented the true heat of occlusion of this quantity of oxygen. The results thus obtained were in close agreement with others obtained by an indirect method, and, as a mean, the value found was 11·0 Cal. per gram of oxygen occluded. This number is almost identical with that given by Thomsen for the heat of formation of platinous hydroxide; this suggests the possibility that the two phenomena may be identical, the water necessary being present in platinum black dried in a vacuum. A. L.

Occlusion of Hydrogen and Oxygen by Palladium. By LUDWIG MOND, WILLIAM RAMSAY, and JOHN SHIELDS (*Proc. Roy. Soc.*, 1897, **62**, 290—293. Compare preceding abstract).—Palladium black, prepared in the same way as platinum black, contains 1·65 per cent. of oxygen, or, taking the density of palladium black as 12·0, 138 volumes of oxygen. Unlike the oxygen in platinum black, however, it cannot be removed at a dull red heat in a vacuum, but must be removed by ignition in a stream of hydrogen. Palladium black, dried at 100°, contains 0·72 per cent. of water, and assuming that the oxygen exists as PdO, the composition of the substance is Pd = 86·59; PdO = 12·69; H_2O = 0·72 per cent.

Palladium black absorbs oxygen when heated in it, at least up to a red heat, and yields a brownish-black substance which does not lose its oxygen at a red heat in a vacuum; the amount absorbed is nearly 1000 volumes, or about three-fourths of that required for the complete formation of the oxide PdO.

Palladium black was found to absorb over 1000 volumes of hydrogen, of which only 873 are occluded, the rest having formed water with the oxygen originally present. About 92 per cent. of the occluded gas was slowly pumped off at the ordinary temperature, and most of the remainder at 444°. Increase of the pressure of the hydrogen from 1 atmosphere to 4·6 had no influence on the quantity absorbed at the ordinary temperature. The pure palladium sponge remaining after the foregoing experiment occluded 852 volumes of hydrogen, and of this 98 per cent. was extracted in a vacuum at the ordinary temperature.

New palladium foil refused to occlude hydrogen after ignition in the gas, and even after repeated charging and discharging with the gas electrolytically. After powerful ignition on the blowpipe flame, however, when it was probably alternately oxidised and deoxidised, it was finally induced to absorb hydrogen to the extent of 846 volumes, or about the same amount as the black or sponge. The hydrogen thus occluded is slowly given off in a vacuum at the ordinary temperature, and rapidly and almost completely at 100°.

The heat of occlusion of hydrogen by palladium black was measured in nearly the same way as in the case of platinum black (see preceding abstract). Favre's statement that the heat of occlusion remains constant for different fractions of hydrogen was confirmed, and it was found that +46·4 Cal. was developed per gram of hydrogen occluded, or if the work done by the atmosphere be allowed for, the value becomes 43·7 Cal.

The heat developed per gram of oxygen absorbed was also determined in an indirect manner and found to be +11·2 Cal. This number, referred to 16 grams of oxygen, is intermediate between the values found by Thomsen for the heat of formation of palladious and palladic hydroxides, and may be consistent with the formation of either or both of these substances; this fact, taken in conjunction with the similar results obtained in the case of platinum black, favours the view that the occlusion of oxygen by palladium and platinum is a true oxidation phenomenon.

From the investigation of the atomic ratio of palladium to hydrogen in the fully charged metal, the authors conclude that the amount of hydrogen absorbed is independent of the form of the metal, and that the atomic ratio varies between 1·37 and 1·47.

Hoitsema has shown that Troost and Hautefeuille's supposition, that a compound of the formula Pd_2H is formed, is not warranted. The composition of fully charged palladium hydrogen corresponds closely with the formula Pd_3H_2 suggested by Dewar, but is almost the only evidence in favour of the existence of such a definite chemical compound.

The results do not favour the view that the heat of occlusion of a gas represents the heat of condensation or liquefaction, or of the heat of solidification or fusion. A. L.

Mineralogical Chemistry.

Mineral Intergrowths. By ARVID G. HÖGBOM (*Bull. Geol. Inst. Univ. Upsala*, 1898, 3, 433—453).—Cases of intergrowth of various minerals are described; namely, of quartz and felspar, beryl and felspar, quartz and muscovite, quartz and tourmaline, quartz and calcite, leucite and mica. Only in a few cases is there any definite crystallographic orientation of the two minerals with respect to each other. In the case of leucite and mica (in lava from Frascati, near Rome), a large plate of bronze mica encloses numerous grains of leucite, the structure of the whole being pœcilitic. The grains of leucite have sharp crystal outlines, but, under the microscope, they are seen to be built up of several differently orientated individuals with a stronger birefringence than ordinary leucite. Analysis of this pseudo-leucite gave,

SiO_2.	Al_2O_3.	Fe_2O_3.	CaO.	MgO.	K_2O.	Na_2O.	Loss on ignition.	Total.
58·20	24·28	1·74	0·50	trace	11·32	0·93	2·85	99·82

This differs from fresh leucite in containing considerably less potash, which has possibly been partly replaced by water. Iron is due to inclosed impurities. L. J. S.

Native Lead and Copper from Franklin Furnace, New Jersey. By WARREN M. FOOTE (*Amer. J. Sci.*, 1898, [iv], **6**, 187—188).—Small quantities of native lead have recently been found at Franklin Furnace, New Jersey, in association with native copper, garnet, axinite, &c., and also with rœblingite (Abstr., 1897, ii, 563) and another silicate containing lead. This association of native lead with silicates of lead is well known from Sweden. L. J. S.

Constitution of Arsenopyrite [= Mispickel]. By F. W. STARKE, H. L. SHOCK, and EDGAR F. SMITH (*J. Amer. Chem. Soc.*, 1897, **19**, 948—952. Compare Abstr., 1895, ii, 17, 316).—Mispickel (FeAsS) has been considered as iron sulphide (FeS_2) with the sulphur partly replaced by As'', or as iron arsenide ($FeAs_2$) containing S'''. In attempting to determine the true constitution of the mineral, the following experiments were made.

When heated in hydrogen, all the sulphur is expelled as hydrogen sulphide, whilst the iron and practically all the arsenic remain; this indicates that the sulphur is less intimately combined with the iron than is the arsenic. Pyrites and marcasite lose half their sulphur when heated in hydrogen.

Heating with ammonium chloride in nitrogen, and dissolving in water, gave indications of the presence of much ferrous, but only a little ferric, iron.

Heating with copper sulphate solution in sealed tubes and titrating with permanganate showed the presence of much ferrous iron and arsenious acid.

Heating in a current of dry hydrogen bromide showed the presence of about 28 per cent. of ferrous iron, and in dry hydrogen chloride of 30·86, 30·55, 30·16 per cent. Since there is 34·35 per cent. of iron in mispickel, this leaves about 4 per cent. for ferric iron.

The formula of mispickel is therefore given provisionally as $14Fe''As'''S,2Fe'''As'''S$. Experiments to determine the molecular weight by observing the influence of mispickel on the solidification point of alloys were without result. No differences in the specific heat and electrical conductivity of pyrites and marcasite respectively could be detected. L. J. S.

[Magnetite and Pyrrhotite]. By G. NYIREDY (*Zeit. Kryst. Min.*, 1898, **30**, 184; from *Értesitő az erd. Muzeum egyl. orv.-term.-tud. szakosztályából.*, 1896, **21**, 123—128, 29—31. Compare Abstr., 1896, ii, 657). I. mean for massive magnetite from Vaskő; sp. gr. 4·696. II. Pyrrhotite from Borév; III. from Ó-Radna; IV. from Oravicza.

	SiO_2.	Fe.	O.	S.	Total.
I.	5·72	68·10	25·93	—	99·75
II.	4·42	57·68	—	37·66	99·76
III.	4·92	57·30	—	37·42	99·64
IV.	7·25	55·92	—	36·48	99·65

L. J. S.

Krennerite from Cripple Creek, Colorado. By ALBERT H. CHESTER (*Amer. J. Sci.*, 1898, [iv], **5**, 375—377).—The rare mineral krennerite has previously only been known from Nagyag; it is now described as bright crystals, associated with quartz and pyrites, from the Independence mine at Cripple Creek. The colour is pale yellowish-bronze, but on the perfect basal cleavage it is tin-white. The mineral is very brittle; H = 2·5. When heated, it decrepitates. Measurements of the orthorhombic crystals are given by S. L. Penfield. Analysis of crystals by W. S. Myers gave results agreeing with the formula $AuTe_2$.

Au.	Ag.	Fe_2O_3.	Insol.	Te.	Total.
43·33	0·45	trace	1·21	[55·01]	100·00

This composition is very close to that of the calaverite from Cripple Creek analysed by Hillebrand, and determined by Penfield to be possibly anorthic (Abstr., 1896, ii, 31). There therefore seems to be three tellurides of gold and silver with the formula $(Au,Ag)Te_2$, namely, the orthorhombic krennerite, the monosymmetric sylvanite, and the anorthic (?) calaverite, although the last two may possibly be identical, only differing in the amount of silver present.

L. J. S.

A New Copper Antimonide. By CARL HLAWATSCH (*Ber. Akad. Wien*, 1895, **104**, i, 275—296).—A crystallised product obtained in the process of smelting tetrahedrite at Brixlegg, Tyrol, is described. After deducting about 10 per cent. of metallic lead, which is enclosed in the crystal plates, analysis gave the formula Cu_2Sb. The crystals are orthorhombic; they are very brittle, and have a violet colour with metallic lustre; sp. gr. = 8·389. The same kind of crystals, but with the formula Cu_8Sb_5, are obtained by melting together copper and antimony; the difference in composition may be due to the presence of metallic antimony in the latter crystals, or the composition may vary without affecting the crystalline form, as in dyscrasite.

L J. S.

Nickeliferous Opal from Tamworth, New South Wales. By DONALD A. PORTER (*Proc. Roy. Soc. N.S.W.*, 1898 [for 1897], **31**, p. xxviii).—Green opal occurs with pinkish chalcedony as thin veins in serpentine in the "Never-never" ranges, near Tamworth, Co. Inglis, N.S.W. It is translucent to opaque, and of a pale to deep apple-green colour. The darker coloured material gives a strong nickel reaction.

L. J. S.

Origin of Corundum in North Carolina. By JULIUS H. PRATT (*Amer. J. Sci.*, 1898, [iv], **6**, 49—65).—Although the corundum of the extensive deposits in North Carolina is rarely found actually in the peridotites (dunite) and serpentines, which are intrusive in the gneiss, the author deduces from field evidence that these peridotites are the mother rock of the corundum. That corundum is capable of crystallising from such a magma, and so can be of igneous origin, has been shown by Morozewicz and by Lagorio (Abstr., 1895, ii, 275 and 276).

L. J. S.

Minerals of the Island San Pietro, Sardinia. By SOLIMANN BERTOLIO (*Zeit. Kryst. Min.*, 1898, **30**, 201—202; from *Boll. R. Com. Geol. Italia*, 1896, **27**, 405—421).—The principal minerals of this locality are felspar (anorthoclase, oligoclase, labradorite), quartz, opal, tridymite, amphibole (arfvedsonite), barytes, and pyrolusite (compare this vol., ii, 81). Analysis of non-crystalline pyrolusite gave,

MnO_2.	MnO.	Fe_2O_3.	Al_2O_3.	CaO.	MgO.	P_2O_5.	SiO_2.	SO_3	Comb. H_2O.	Loss. at 100°.	Total.
36·0	4·0	15·0	5·0	1·0	2·0	0·4	9·1	0·1	6·3	20·5	99·4

It appears to have been deposited from spring-water containing manganese carbonate in solution. L. J. S.

Ktypeite, a New Form of Calcium Carbonate. By ALFRED LACROIX (*Compt. rend.*, 1898, **126**, 602—605).—The pisolites formed in the hot springs of Carlsbad (Bohemia) and Hamman-Meskoutine (Constantine), are usually considered to consist of aragonite, but the author finds that the optical characters agree with neither those of aragonite nor of calcite. Thin sections show, in parallel polarised light, a distorted, black cross, and portions which are dark between crossed nicols give a positive black cross in convergent light; in the material from Hamman-Meskoutine the apparent angle of the optic axes is 50°. The birefringence, about 0·020, is much less than in the optically negative calcite and aragonite, and consequently bright polarisation colours are seen. When heated to low redness, the pisolites violently decrepitate, and detached scales are then observed to be partly transformed into calcite. If a ball be first cracked and gently heated for some time, it becomes completely transformed into calcite without breaking up. The sp. gr., 2·58—2·70, varies, possibly owing to enclosed cryptocrystalline aragonite and to porosity, but is always less than that of calcite (2·72) [previous observers have found it to be near that of aragonite (2·93)]. The violent decrepitation, on account of which the name ktypeite is given, shows that the pisolites must be in a state of considerable strain, and this may possibly explain the optical anomalies observed.

L. J. S.

Aurichalcite from Tuscany. By GIOVANNI D'ACHIARDI (*Jahrb. f. Min.*, 1898, i, Ref., 439; from *Atti Soc. Toscana Sci. Nat.*, 1897, Mem., **16**, 15 pp.).—The small crystals obtained on crushing a crystalline mass of aurichalcite from Campligia Marittima, are shown by microscopical examination to be monosymmetric, with $b : c = 1 : 1·6574$; $\beta = 84° 15'$. There is a distinct cleavage parallel to (100); the optical characters, so far as determined, are given. Aurichalcite (so-called "buratite"), from Valdaspra, gave the same results; this has sp. gr. = 3·00—3·02, and gave, on analysis,

H_2O.	CO_2.	ZnO.	CuO.	CaO.	Fe_2O_3.	Al_2O_3.	Insol.	Total.
9·61	15·71	52·51	18·80	0·45	1·34	trace	2·01	100·43

Formula, $2(Zn,Cu)CO_3,3(Zn,Cu)(OH)_2$, with $Cu : Zn = 2 : 5$.

L. J. S.

Apatite in Granulitic Enclosures in the Puy de Dôme. By A. GONNARD and ADELPHE (*Compt. rend.*, 1898, **126**, 1532—1534).—Enclosures of apatite in volcanic rocks are comparatively rare, but the authors have found chocolate-coloured, hexagonal prisms of this mineral 3 mm. broad and 12 mm. long in a deep brown quartzose mass, and in nodules of an altered white felspar at Chuquet-Genestoux in the Puy de Dôme. Several of the crystals are traversed by a small, central cylindrical canal, possibly filled originally with muscovite that has since disappeared. The apatite contains somewhat considerable quantities of iron, doubtless derived from the volcanic rocks in which it occurs. C. H. B.

[Ferric Sulphate from Minnesota]. By CHARLES P. BERKEY (*Amer. Geologist*, 1898, 21, 153).—In a paper on the geology of St. Croix Dalles, the following analysis, by H. A. Webber, is given of greenish-yellow, rather compact, globular masses, which are abundantly formed as an efflorescence on exposed pyritiferous shales at Taylor's Falls.

SiO_2.	Fe_2O_3.	Al_2O_3.	K_2O.	Na_2O.	CaO.	SO_3.	H_2O.	Organic matter.	Total.
12·946	22·828	4·141	1·844	4·659	2·210	32·500	17·840	trace	98·968

As shown by the presence of silica, the substance is apparently a mixture. L. J S.

Orthoclase as Gangue Mineral in a Fissure Vein. By WALDEMAR LINDGREN (*Amer. J. Sci.*, 1898, [iv], 5, 418—420).—Felspars as a gangue material in ordinary fissure veins are not common; there are several recorded occurrences of orthoclase and albite in gold-quartz and other veins, but anorthite and soda-lime felspars are very rare. A vein on Florida Mountain, in the Silver City mining district of southern Idaho, contains pyrites, copper pyrites, and argentite, with a gangue of quartz and orthoclase. The vein is richest in orthoclase where it traverses granite, there is less where it intersects rhyolite, and none where it intersects basalt. The orthoclase occurs as large, irregular, milk-white grains intergrown with vein-quartz, and enclosing pyrites and argentite, or as crystals coating quartz and lining crevices in the altered granite adjoining the vein. The crystals are of the adularia habit with the forms $m\{110\}$ and $x\{\bar{1}01\}$. Analysis of a crystal by Hillebrand gave,

SiO_2.	Al_2O_3.	K_2O.	Na_2O.	Undet.	Total.	Sp. gr.
66·28	17·93	15·12	0·25	0·42	100·00	2·54

Orthoclase has been formed artificially in the wet way, and this supports the idea that the vein orthoclase has been formed by aqueous deposition. Why it is not of more common occurrence may possibly be due to the frequent presence of carbonated thermal waters in mineral veins. L. J. S.

Rhodolite, a New Variety of Garnet. By WILLIAM E. HIDDEN and JULIUS H. PRATT (*Amer. J. Sci.*, 1898, [iv], 5, 294—296).—A "rose garnet," named rhodolite on account of its rose-red or rhododendron-red colour, occurs as rolled pebbles in the gravels of a brook called Mason's Branch, in Macon Co., North Carolina. Associated with it are quartz (rarely pseudomorphous rhombic dodecahedra), pyrope, corundum of various colours, spinel, bronzite, cordierite, kyanite, fibrolite, hornblende, staurolite, rutile, ilmenite, chromite, monazite, zircon, gold, and sperrylite. This garnet is unusually free from internal flaws and inclusions, and forms a fine gem-stone which in brilliancy resembles the green demantoid from the Urals. Sp. gr. = 3·837 ; analysis gave,

SiO_2.	Al_2O_3.	Fe_2O_3.	FeO.	MgO.	CaO.	Total.
41·59	23·13	1·90	15·55	17·23	0·92	100·32

This agrees closely with the formula $2Mg_3Al_2(SiO_4)_3,Fe_3Al_2(SiO_4)_3$; that is, two molecules of pyrope with one of almandine. L. J. S.

Epidote, &c., from Oulx.

By LUIGI COLOMBA (*Zeit. Kryst. Min.*, 1898, **30**, 203—204 ; from *Atti R. Accad. Sci. Torino*, 1891, **26**, 811—826).—*Epidote.*—The larger crystals are dark olive-green, opaque, and deeply striated, whilst the smaller are light in colour, transparent, and with smooth faces. A list of the observed crystal forms is given. I is the mean of two analyses ; the formula,

$$H_2O,Fe_2O_3,2Al_2O_3,4\tfrac{1}{2}CaO,6\tfrac{1}{2}SiO_2,$$

indicates that the material was not pure.

Actinolite.—Analysis of pure material gave the results under II. With this amphibole is mixed a brownish-yellow mineral which gave analysis III ; it appears to be a decomposition product of epidote and amphibole.

Albite.—This is often green, owing to enclosed epidote. IV is the mean of two analyses. A crystallographic description is given.

	SiO_2.	Al_2O_3.	Fe_2O_3.	FeO.	CaO.	MgO.	Loss on ignition.		Total.
I.	37·48	20·39	15·30	—	23·99	0·48	1·89		99·53
II.	54·65	0·47	—	10·37	16·13	18·68	—		100·30
III.	46·17	8·03	$\underbrace{\qquad\qquad}_{10{\cdot}51}$		22·63	12·92	Na_2O	K_2O	100·26
IV.	67·66	17·03	0·75	—	3·79	0·14	9·16	0·85	99·38

Calcite, quartz, hæmatite, and pyrites are also described from this locality, which is situated in the upper valley of the Dora Riparia, Piedmont. L. J. S.

Anthophyllite, Enstatite, and Emerald from North Carolina.

By JULIUS H. PRATT (*Amer. J. Sci.*, 1898, [iv], **5**, 429—432).—*Anthophyllite.*—Boulders found on the surface of an outcrop of dunite near Bakersville, in Mitchell Co., North Carolina, contain prismatic crystals of anthophyllite embedded in penninite ; the least altered are transparent, and pale clove-brown to flesh-red in colour, and show the forms {110} and {010} ; analysis I. Fibrous anthophyllite also occurs at Corundum Hill, in Macon Co., but that described by Penfield (Abstr., 1891, 529) as being from this locality is probably from Bakersville.

Enstatite.—The enstatite from Corundum Hill, in Macon Co., which is commonly called anthophyllite, occurs as a tough rock, continuous with the dunite, composed of a mass of interlocking, bladed, greyish crystals. Analysis II shows it to be impure, and to be composed of enstatite, 44·5 ; serpentine, 35 ; and talc, 20·5 per cent.

Enstatite (*Bronzite*).—A bronzite-diopside rock (websterite) occurs in the midst of dunite near Webster, in Jackson Co. The bronzite has a resinous-brown colour with a bronze-like lustre, and the interlocking crystals form a very tough rock. Analysis III gives the formula (Mg,Fe)O,SiO_2, with Mg : Fe = 7 : 1 (Anal. I—III by Baskerville).

	SiO_2.	Al_2O_3.	Cr_2O_3.	FeO.	MnO.	MgO.	CaO.	H_2O.	Total.
I.	56·40	1·15	—	11·40	—	28·68	0·50	1·63	99·76
II.	51·64	0·12	—	9·28	0·56	31·93	0·45	5·45	99·43
III.	53·62	0·97	0·50	9·06	—	33·53	1·75	0·19	99·62

Beryl (*Emerald*).—Beryl is common in granite veins, but the emerald-green variety is rare; the latter is found in a pegmatite vein, composed of quartz and albite with accessory tourmaline and garnet, in the gneisses and schists of Mitchell Co. L. J. S.

Clinohedrite: A New Mineral from Franklin, New Jersey. By Samuel L. Penfield and H. W. Foote (*Amer. J. Sci.*, 1898, [iv], 5, 289—293).—The new mineral is from the Trotter Mine at Franklin, New Jersey, where it is associated with willemite, garnet, phlogopite, axinite, and datolite. The monosymmetric crystals are interesting on account of their hemihedrism, there being a plane of symmetry, but no axis of symmetry (domatic class of Groth); owing to the absence of parallel faces (except b 010), the crystals present a peculiar inclined-faced character, hence the name clinohedrite. $a : b : c = 0·6826 : 1 : 0·3226$; $\beta = 76° 4'$. There is a perfect cleavage parallel to b(010). H = 5·5; sp. gr. = 3·33. The crystals are pyroelectric; they are often transparent, and the colour varies from amythestine to nearly colourless or white. The optic axial plane and the obtuse bisectrix are perpendicular to b(010); the birefringence is negative and not very strong. The mean of two analyses is

SiO_2.	ZnO.	MnO.	CaO.	MgO.	H_2O.	$(Fe,Al)_2O_3$	Total.
27·22	37·44	0·50	26·25	0·07	8·56	0·28	100·32

This agrees closely with $H_2ZnCaSiO_5$, or, as the water is not expelled much below a faint red heat, $SiO_3(ZnOH)(CaOH)$. This formula is analogous to that of hemimorphite, $H_2Zn_2SiO_5$, or $SiO_3(ZnOH)_2$. [The name clinohedrite is preoccupied.] L. J. S.

Mineralogical Notes. By C. H. Warren (*Amer. J. Sci.*, 1898, [iv], 6, 116—124).—(1) *Melanotekite from New Mexico.*—This mineral, previously only known from Sweden, has recently been found at Hillsboro, associated with cerussite and a brown, jasper-like material; it has a dark-brown to almost black colour, and gives an ochre-yellow streak resembling that of limonite. Cavities are lined with minute orthorhombic crystals of prismatic habit; $a : b : c = 0·6338 : 1 : 0·9126$. The mean of two very close analyses is,

SiO_2.	PbO.	Fe_2O_3.	X.	H_2O.	Total.	Sp. gr.
15·49	55·56	27·51	0·82	0·68	100·06	5·854

This agrees closely with the formula $2Fe_2O_3,3PbO,3SiO_2$, or, written as a basic salt of orthosilicic acid, $(Fe_4O_3)Pb_3(SiO_4)_3$, the radicle, Fe_4O_3 being hexavalent as in limonite, $Fe_4O_3(OH)_6$. The formula previously given for melanotekite is $2PbO,Fe_2O_3,2SiO_2$, and for the isomorphous kentrolite, $2PbO,Mn_2O_3,2SiO_2$. The four earlier analyses of these two minerals show considerable variations, and three of them agree better with the new formula than with the old.

(2) *Pseudomorphs after phenakite from Greenwood, Maine.*—These are large, whitish crystals, up to 12 in. diam., and weighing 28 lbs., with rough, pitted surfaces; they are of unusual habit, but measurements show the presence of the characteristic forms and symmetry of phenakite. In thin sections, they are seen to consist of quartz and a micaceous mineral, which, as seen from the following analysis, is probably cookeite.

Al_2O_3.	Fe_2O_3.	BeO.	Li_2O.	Na_2O.	K_2O.	H_2O.	SiO_2.	Total.
19·30	0·54	Nil	0·68	1·17	0·67	5·53	[72·11]	100·00

(3) *Supposed pseudomorphs after topaz from Greenwood, Maine.*—Hollow, prismatic shells of quartz, lined with small crystals of quartz and rounded prominences of cookeite, show the topaz forms $m\{110\}$ and $c\{001\}$.

(4) *Crystallised Tapiolite from Topsham, Maine.*—This occurs in the felspar quarries at Topsham as simple and twinned tetragonal crystals, 2 cm. diam.; the twinned crystals have the same orthorhombic habit as recently described by Brögger (this vol., ii, 388). The high sp. gr., 7·66—7·87, of the crystals indicate that they are tapiolite ($FeTa_2O_6$) rather than mossite ($FeNb_2O_6$). Only a trace of manganese is present.

(5) *Crystallised Tantalite from Paris, Maine.*—The crystals are orthorhombic, with forms corresponding to those of columbite ($FeNb_2O_6$), but the high sp. gr., 7·26, indicates that they are tantalite ($FeTa_2O_6$). It differs from the tantalites previously described in containing little or no manganese.

(6) *Cobaltiferous Calamine from Boleo, Lower California.*—This occurs as small, crystalline particles, of a delicate pink colour, embedded in gypsum, and associated with atacamite; sp. gr. = 3·874. The mean of two analyses is,

CO_2.	FeO.	ZnO.	CoO.	MnO.	MgO.	CuO.	Cl.	H_2O.	Total.
36·94	0·33	39·02	10·25	3·36	7·22	1·65	0·11	1·29	100·17

Deducting CuO, H_2O, and Cl as atacamite, this gives the formula RCO_3.

L. J. S.

Erionite, a New Zeolite. By ARTHUR S. EAKLE (*Amer. J. Sci.*, 1898, [iv], **6**, 66—68, and *Zeit. Kryst. Min.*, 1898, **30**, 176—178).—This zeolite occurs in a rhyolite-tuff at Durkee, Oregon, as white tufts on opal, or as compactly matted fibres filling rock fissures. The very delicate threads, resembling fine, woolly hairs, are snow-white, and have a pearly lustre; sometimes they are coated with a thin shell of white opal. The optical characters point to orthorhombic symmetry, there being an acute positive bisectrix parallel to the length of the fibres. Sp. gr. = 1·997. The mineral, when heated, emits an odour of burning, gives off water of alkaline reaction, and easily fuses to a clear, colourless glass. Over sulphuric acid, there is a loss of 6·95, at 110° of 7·68, and at 280° of 15·25 per cent., this being regained from moist air; up to 400°, there is no further loss, the remainder going off only at a low, red heat. Alkaline water is still given off at 200°, but not at 280°; the amount of ammonia in the mineral is 0·22 per cent. The organic matter cannot be extracted by boiling water or acids. The fibres are soluble with great difficulty in hydrochloric acid, with separation of pulverulent silica. The mean of three analyses is,

SiO_2.	Al_2O_3.	CaO.	MgO.	K_2O.	Na_2O.	H_2O.	Total.
57·16	16·08	3·50	0·66	3·51	2·47	17·30	100·68

Formula, $6SiO_2,Al_2O_3,(Ca,K_2,Na_2)O + 6H_2O$, or $H_2Si_6Al_2(Ca,K_2,Na_2)O_{17} + 5H_2O$. This is the formula of stilbite, with lime largely replaced by alkalis; the physical characters are, however, distinct from those of stilbite, and the new name, *erionite*, is given on account of the woolly nature.

Opal occurs as large masses filling cavities in the tuff, and it sometimes shows a rich play of colours; analysis of the more common milk-opal gave SiO_2, 95·56; Al_2O_3, trace; H_2O, 4·14 per cent.

L. J. S.

Barium-Heulandite and other Zeolites from Sardinia. By Domenico Lovisato (*Jahrb. f. Min.*, 1898, i, Ref. 446—447; from *Rend. R. Accad. Lincei*, 1897, **6**, i, 260—264, and *Riv. Min. Crist. Ital.*, 1898, **18**, 33—38).—Zeolites are of comparatively rare occurrence in Sardinia; the volcanic rocks contain heulandite, stilbite, chabazite, and analcite, and the mineral veins, laumontite and harmotome. Cavities in hornblende-andesite at Cape Pula are encrusted with a pale rose-coloured, transparent heulandite; the crystals show the forms {110}, {100}, {001}; sp. gr. = 2·182; analysis gave,

SiO_2.	Al_2O_3.	BaO.	CaO.	Na_2O.	H_2O.	Total.
56·67	16·86	2·55	3·61	3·27	17·05	100·01

This may, then, be called barium-heulandite. The same mineral also occurs in trachytic and andesitic rocks in the mountains of Monastir, but not in the basaltic rocks, which contain stilbite. Notes are added on the occurrence, &c., of the other zeolites mentioned above.

L. J. S.

Epidote from Piedmont. By Giovanni Boeris (*Jahrb. f. Min.*, 1898, i, Ref. 443; from *Atti R. Accad. Sci. Torino*, 1897, **32**, 670—680, and *Riv. Min. Crist. Ital.*, 1898, **20**, 65—76).—At the junction of the green schists and the serpentine schists of the Comba di Compare Robert, near Avigliana in the Piedmontese Alps, there is found here and there a crystalline aggregate of epidote, chlorite, sphene, and garnet. On the walls of calcite veins are good crystals of epidote, garnet, and diopside; crystallographic descriptions are given of these minerals. The epidote gave $2V_{Na} = 76° 1'$, $\rho > v$, &c. (compare Abstr., 1896, ii, 371); sp. gr. = 3·462. Analysis gave,

SiO_2.	Al_2O_3.	Fe_2O_3.	FeO.	CaO.	MgO.	H_2O.	Total.
37·73	21·11	16·22	0·32	22·55	trace	1·98	99·91

Formula, $H_2O,4CaO,2Al_2O_3,Fe_2O_3,6SiO_2$. L. J. S.

Minerals of a Volcanic Vent in the Puy de Dôme. By Alfred Lacroix and Paul Gautier (*Compt. rend.*, 1898, **126**, 1529—1532).—The authors describe in detail the minerals, and more particularly the crystallised silicates, found in an ancient volcanic vent at Royat, in the Puy de Dôme. The projected matter consists of fine ashes and porous, basaltic lapilli, enclosing large numbers of fragments of granite, arkose, orthoclase, and quartz, all more or less fused. The crystallised silicates are unusually abundant, doubtless owing to the action of the gases in the vent, and they include pyroxene in several varieties, biotite, augite, labradorite, andesine, and albite, or anorthite, together with specular hæmatite and magnetite. It is probable that they were formed by the action of the gases on granitic enclosures which had been fused to vesicular glasses. C. H. B.

"Mineral Soap." By WILBUR C. KNIGHT (*Engineering and Mining Journal* (New York), 1897, **63**, 600—601).—In many parts of Wyoming, the Fort Benton (Cretaceous) shales contain a bed of peculiar clay, which is extensively worked at Rock Creek, Albany Co. It has an unctuous feel, and, on exposure, changes in colour from greenish-yellow to light cream. Sp. gr. = 2·132. With it are associated thin bands of secondary gypsum and mirabilite. The extremes of four partial analyses, made on material from different counties, are,

SiO_2.	Al_2O_3.	Fe_2O_3.	MgO.	CaO.	Na_2O.	SO_3.	H_2O.
59·78	12·62	2·40	1·82	0·73	—	0·88	9·17
65·24	17·12	3·70	4·14	4·12	0·20	1·53	16·26

For this clay, the name taylorite is proposed [a name already in use]. L. J. S.

Rocks and Minerals from California. By HENRY W. TURNER (*Amer. J. Sci.*, 1898, [iv], **5**, 421—428).—(1) A peculiar quartz-amphibole-diorite.—This occurs as a dyke-like streak in granite-diorite on the dividing ridge between Butte and Plumas counties; it is a greyish-green rock of medium grain, composed of amphibole, plagioclase (oligoclase or andesine), and quartz with accessory rutile, zircon, apatite, and magnetite, and secondary epidote, chlorite, and sericite. Analysis by Hillebrand is given under I (traces of Li_2O and P_2O_5 are also present). The abundant greyish-green amphibole occurs as short, idiomorphic needles enclosed in felspar and quartz; extinction angle, 23°. Analysis II, by Valentine, shows that it contains too much alumina to be called actinolite.

	SiO_2	TiO_2.	Al_2O_3.	Fe_2O_3.	FeO.	MnO.	NiO.	CaO.	SrO.	BaO.	MgO.	K_2O.	Na_2O.	H_2O.	Total.
I.	54·64	0·61	12·09	1·81	5·03	0·13	0·05	7·74	trace	0·05	11·86	1·01	2·35	2·56	100·01
II.	50·08	0·76	8·13	2·69	6·71	0·49	—	11·21	Nil	—	16·31	0·46	1·22	1·40	99·46

(2) A new amphibole-pyroxene rock from Mariposa Co.—This occurs as small, probably intrusive, masses in slate, and consists of grains of original amphibole and augite with a little quartz and some pyrrhotite. Large phenocrysts of amphibole enclose grains of augite, pyrrhotite, and amphibole similar to those in the ground-mass.

(3) A quartz-alunite rock.—Three sharp buttes called Tres Cerritos, in Mariposa Co., are composed of augite-porphyrite-tuffs and clay-slate which have been subjected to solfataric action. Most of the altered rocks are light brown, highly siliceous, and resemble quartzite in appearance; under the microscope, they are seen to consist of quartz with a mineral which is shown, by the following analysis, made by Valentine on

material separated by a heavy liquid, to be alunite; sp. gr. = 2·78; also traces of MgO and P_2O_5.

SiO_2.	TiO_2.	Al_2O_3.	Fe_2O_3.	CaO.	K_2O.	Na_2O.	H_2O.	SO_3.	Total.
2·64	0·40	38·05	0·23	0·55	4·48	2·78	11·92	38·50	99·55

(4) Zircons from gravels.—Small crystals of zircon have been isolated from the heavy sands obtained in the gravel washings at Eagle Gulch, Plumas Co.

(5) Molybdenite.—Three new occurrences are noted.

(6) Tellurium, selenium, and nickel in gold ores.—Tellurium has long been known to occur in various Californian gold ores; new localities of such occurrences are here given.

(7) Carbonaceous material in quartz.—Many veins in the Gold Belt region of the Sierra Nevada are composed of a dark quartz containing very finely disseminated colouring matter. Eight grams of this quartz dissolved in hydrogen fluoride left several milligrams of carbonaceous residue.

(8) Berthierite.—An ore containing iron, antimony, sulphur, &c., is recorded doubtfully as berthierite, but is more probably a mixture.

L. J. S.

Sölvsbergite and Tinguaite from Essex Co., Mass. By Henry S. Washington (*Amer. J. Sci.*, 1898, [iv], 6, 176—187).—The igneous rocks of Essex Co., Massachusetts, are analogous to those of the Christiania region described by Brögger. Glaucophane-sölvsbergite, occurring as dykes in granite at Cape Ann, is a dark, fine-grained rock of sp. gr. = 2·703. Under the microscope, it is seen to be holocrystalline with microgranitic structure, and to be composed of glaucophane-riebeckite (24·4 per cent., as calculated from the analysis I of the rock), albite (39·0), orthoclase (29·8), quartz (4·3), with accessory sphene, cordierite, and apatite. The hornblende is strongly pleochroic, and has an extinction angle of 4—7°; as calculated from the rock analysis, it is a mixture of ferrous-glaucophane and riebeckite in the ratio of 3 : 2.

From analysis II, of soda-granite from Quincy, Mass., is calculated the following mineralogical composition: riebeckite-glaucophane (Rb_9Gl_2 = 14·3 per cent.), albite (27·7), orthoclase (27·2), quartz (30·2). This is compared with Brögger's grorudite from Norway.

Analcite-tinguite, occurring as dykes in granite near Manchester, is a dark, very compact rock of sp. gr. = 2·474. Needles and grains of ægirite (10·2 per cent., as calculated from analysis III of the rock) and phenocrysts of felspar (albite, 20·9; orthoclase, 17·3) lie in a clear, colourless ground of analcite (37·4) and nephelite (10·9). Dilute hydrochloric acid dissolves 49·24 per cent. of the rock.

	SiO_2.	TiO_2.	Al_2O_3.	Fe_2O_3.	FeO.	MnO.	MgO.	CaO.	Na_2O.	K_2O.	H_2O.	P_2O_5.	Total.
I.	64·28	0·50	15·97	2·91	3·18	trace	0·03	0·85	7·28	5·07	0·20	0·08	100·33
II.	73·93	0·18	12·29	2·91	1·55	trace	0·04	0·31	4·66	4·63	0·41	—	100·91
III.	56·75	0·30	20·69	3·52	0·59	trace	0·11	0·37	11·45	2·90	3·22	—	99·92
									SO_3 trace, Cl 0·28				

L. J. S.

Weathering of Diabase in Virginia. By THOMAS L. WATSON (*Amer. Geologist*, 1898, **22**, 85—101. Compare Abstr., 1897, ii, 107).—Olivine-diabase occurs as dykes intersecting the crystalline schists near Chatham, Pittsylvania Co., Virginia; it shows various stages of decay, and the final product is a tough, bright red clay with embedded boulders. The large pleochroic crystals of augite extracted from the fresh rock gave analysis I; angle of optical extinction, $\mathfrak{c}:c = 47°$; sp. gr. = 3·232; it encloses some magnetite. The felspar (labradorite) gave II; after deducting magnesium and iron (due to enclosures of magnetite and augite) this gives Ab_8An_9; the angle of optical extinction on (010) is 22°; sp. gr. = 2·697. The bulk analysis of the fresh rock is given under III; sp. gr. = 3·026. The partially weathered rock gave IV; here, as shown by microscopical examination, the olivine has been altered. As shown by this analysis, practically the only change is a slight hydration, and loss of magnesia. The completely weathered product gave V.

	SiO_2.	Al_2O_3.	Iron as Fe_2O_3.	CaO.	MgO.	Na_2O.	K_2O.	H_2O.	Total.
I.	48·83	4·41	10·01	20·51	17·11	—	—	—	100·87
II.	49·65	24·49	5·98	11·02	4·31	[4·55]	—	—	100·00
III.	45·73	13·48	11·60	9·92	15·40	3·24	0·47	0·94	100·78
IV.	47·87	14·43	11·55	10·45	10·58	3·47	0·61	1·82	100·78
V.	37·09	13·19	35·69	0·41	0·57	1·75	0·33	11·83	100·86
IIIA.	12·78	9·10	8·75	4·37	8·65	not det.		0·94	44·59
IVA.	not det.	10·93	5·83	4·49	4·28	0·91	0·45	1·82	28·71
VA.	12·72	8·22	28·25	0·02	0·20	1·00	0·20	11·83	62·44

Calculating from III and V, on the assumption that the ferric oxide has remained constant in amount, it is seen that there has been a total loss of 70·31 per cent. of the original material, and that 73·64 per cent. of the original silica, 68·19 of the alumina, and most of the lime, magnesia, and alkalis have been removed.

The analyses of the portions of the fresh rock, partially altered rock, and completely decomposed material, which are soluble in half-normal hydrochloric acid and in sodium carbonate solution, are given under IIIA, IVA, and VA respectively. The three samples of material were digested with hydrochloric acid of different strengths, and the several analyses of the soluble portions show slightly varying results. Experiments show that the acid acts on the various minerals in the same order as do the processes of weathering, the olivine being attacked first, and the augite and magnetite last. L. J. S.

Meteorite from Toubil, Gov. Yeniseisk. By A. KHLAPONIN (*Verh. russ.-kais. min. Ges.*, 1898, **35**, 233—241).—This meteorite was found in 1891, in the placers of the stream Toubil, dist. Atchinsk, gov. Yeniseisk, Siberia, and about 265 miles from Krasnoiarsk; it weighs 21,962 grams, and measures 23 × 17·8 × 11 cm. Etched surfaces show well-marked, triangular Widmanstätten figures. The hydrochloric acid residue consists of black, carbonaceous matter, gelatinous silica, and needles of rhabdite. Analysis of the last (on 17 mg.) gave,

Fe.	Ni (and trace Co).	P.	Total.
53·53	34·12	9·41	97·06.

This gives the formula Fe_3Ni_2P, whilst the usual formula for rhabdite is $(Fe,Ni,Co)_3P$. The bulk analysis of the meteorite is,

Fe.	Ni.	Co.	Ca.	Mg.	SiO_2.	Mn.	As.
95·183	3·385	0·140	0·205	0·033	0·075	0·090	0·019

Cl.	C.	O.	S.	Rhabdite.	Total.
0·038	0·120	0·093	Nil	0·425	99·806.

Assuming the silica, magnesium, and calcium to be present as monticellite, there is still an excess of calcium to be accounted for. The oxygen shown above probably represents rust. L. J. S.

Jerome (Kansas) Meteorite. By HENRY S. WASHINGTON (*Amer. J. Sci.*, 1898, [iv], 5, 447—454).—This stone was found in 1894 on the Smoky Hill River, about 15 miles east of Jerome, in Gove Co., Kansas. The largest piece weighs 62 lbs., and measures 12 × 9 × 10 in., the smaller pieces weigh altogether $3\frac{1}{4}$ lbs. The surface is covered with a thin, dark-brown crust, and is somewhat weathered. The structure is fine-grained and compact. Sp. gr. = 3·466. Under the microscope are seen numerous chondrules of bronzite and of olivine, with fragmentary crystals of olivine, bronzite, and a little pyroxene, in a rather brecciated groundmass of the same minerals, together with some interstitial matter, which seems to be glass; there are a few fragments of plagioclase, but no troilite was seen. Nickel-iron is present as small, angular masses partly altered to limonite. For the separation of the metallic iron, Eggertz's iodine method was used, but a good method is wanted for the determination of iron, ferrous oxide, and ferric oxide, and of nickel and nickelous oxide, &c. ; some suggestions are given in the paper. Analysis of the nickel-iron gave,

Fe.	Ni.	Co.	Cu.	Total.
89·69	10·01	0·32	not det.	100·00

From the analyses of the portions soluble and insoluble in hydrochloric acid, the bulk analysis and the following mineralogical composition of the stone are calculated. Nickel-iron, 4·3 ; troilite, 5·2 ; chromite, 0·9 ; schreibersite ?, 0·8 ; olivine, 30·2 ; bronzite, 23·6 ; pyroxene, 5·0 ; oligoclase, 6·6 ; orthoclase, 1·6 ; limonite, 20·2 ; NiO, 1·6 = 100·0. L. J. S.

San Angelo Meteorite. By H. L. PRESTON (*Amer. J. Sci.*, 1898, [iv], 5, 269—272).—This iron was found in 1897 partially buried in the soil on the prairie called "Lipan Flats," seven miles south of San Angelo, in Tom Green Co., Texas. It weighs 88 kilos., and measures 51 × 29 × 14 cm. ; the surface shows large pittings and is much oxidised, whilst a broken surface shows a well-marked octahedral structure. On an etched surface, rhombic-shaped Widmanstätten figures are sharp and distinct, and the so-called Laphamite lines are prominent. Troilite nodules are scarce. Small fissures, rarely filled with a substance resembling graphite, sometimes follow the lines of the Widmanstätten figures (compare this vol., ii, 343). Sp. gr. 7·7 ; analysis by Mariner and Hoskins gave,

Fe.	Ni.	Co.	Cu.	P.	S.	Mn.	Si.	C.	Total.
91·958	7·860	trace	0·040	0·099	0·032	trace	0·011	trace	100·000.

L. J. S.

Mineral Water of the Royal Springs of S. Agnese at the Bagno of Romagna. By ATTILIO PURGOTTI and G. ANELLI. (*Gazzetta*, 1898, **28**, i, 349—355).—The mineral water of the Royal Springs of S. Agnese at the Bagno di Romagna issues at 40—43·7° and is credited with therapeutic properties; it has the sp. gr. 1·00088 at 15°/4°, and 10,000 grams contain the following dissolved constituents in grams.

$CaH_2(CO_3)_2$	0·1735	NaI	0·00019
$NaHCO_3$	11·0074	$Na_2B_4O_7$	1·1484
K_2SO_4	0·1325	SiO_2	0·3060
Na_2SO_4	0·1049	CO_2 (free)	0·2200
$MgCl_2$	0·1187	Organic matter	0·0110
LiCl	0·0034	O_2 at N.T.P.	10 c.c.
NH_4Cl	0·0585	N_2 ,,	54 c.c.
NaCl	0·2116	CH_4 ,,	108 c.c.
NaBr	0·00093		

W. J. P.

Water of the Sacred Well at Mecca. By MAURITS GRESHOFF (*Rec. Trav. Chim.*, 1897, **16**, 354—355).—The following table gives the results of analyses (expressed in grams per litre) made by Van Romburg in 1886, I. and by the author in 1896, II.

	Residue at 180°.	Cl.	SO_3.	N_2O_5.	CO_2.	SiO_2.	CaO.	MgO.	Na_2O.	K_2O.	P_2O_5.
I.	3·165	0·556	0·395	0·725	0·317	0·047	0·412	0·152	0·578	0·272	traces.
II.	3·592	0·663	0·412	0·461	0·486	0·052	0·515	0·157	0·916	0·224	traces.

Sp. gr. I = 1·0025 at 18°. II = 1·0026 at 15°.

J. J. S.

Physiological Chemistry.

Comparative Physiology of Digestion. I. Digestion of the Larva of Tenebrio Molitor (Meal-Worm). By WILHELM BIEDERMANN (*Pflüger's Archiv.*, 1898, **72**, 105—162).—The paper is mainly anatomical and histological. The most important chemical points noted are, (1) the presence in the epithelial cells of the mid-gut of a number of crystalline clumps, which are of proteid nature, and which function as 'reserve material.' (2) The existence of an acid reaction in the upper half of the mid-gut; this is independent of the food taken, and is also found in the fasting condition. The contents of the lower part of the intestine are alkaline; this corresponds with anatomical differences in the cells of the lining epithelium. The acidity is due to acid phosphates. (3) The juice contains an energetic amylolytic enzyme, converting starch into dextrose, and an inverting enzyme, but no cellulose dissolving enzyme (cytase) was discovered. The course of proteolytic digestion closely resembles that by trypsin; tyrosine, but not leucine, crystals were separated out from the final products. Fats are split into fatty acids and glycerol; fat is not absorbed in the form of an emulsion.

W. D. H.

Gastric Digestion of Caseinogen. By Franz Alexander (*Zeit. physiol. Chem.*, 1898, **25**, 411—429).—The products of peptic digestion were separated by Pick's method of fractional precipitation with ammonium sulphate. The results, on the whole, closely coincide with those he obtained with Witte's peptone. The peptones obtained do not give Millon's reaction. Some of the results appear to indicate that mixed with caseinogen is a small amount of an albuminate.

W. D. H.

Digestion of Caseinogen by Pancreatic Juice. By Ugo Biffi (*Virchow's Archiv*, 1898, **152**, 130—157).—Under favourable circumstances, caseinogen is completely digested, about 4 per cent. of the weight of the proteid being removed as tyrosine. Casein-antipeptone has the percentage composition : C, 49·7 ; H, 7·2 ; N, 16·3 ; O, 25·2 ; S, 1·3 ; otherwise, it shows the properties and reactions of fibrin-antipeptone ; the proteoses also agree in their reactions with those obtained from fibrin. The phosphorus of the caseinogen is found in two forms in the products of digestion, namely, as phosphoric acid, and as a compound not precipitable by magnesia mixture. The amount of phosphoric acid increases with the duration of the digestion and the amount of ferment present. W. D. H.

Behaviour of Proteids which contain Phosphorus, in Metabolism. By Franz Steinitz (*Pflüger's Archiv.*, 1898, **72**, 75—104).—The present experiments, made on dogs, were carried out in the usual way by analyses and comparison of the intake and output in urine and fæces ; the special point investigated, however, was whether proteids containing phosphorus lead to the laying down of phosphorus in the body. The proteids used were casein and vitellin ; in the case of vitellin, however, there was some doubt as to whether it was not mixed with lecithin. The phosphates passed in the urine are, of course, allowed for. The general result of the experiments is that a considerable proportion of the phosphorus is retained in the body ; the similar experiments previously made by Marcuse on casein led to the same result, but the proportion he found retained within the body was smaller. Relatively more nitrogen than phosphorus (compared to what is present in the casein given) is retained ; this proportion between nitrogen and phosphorus retained was smaller in the experiments in which vitellin was used, but greater than in those where nucleo-histon was employed.

Control experiments were made with myosin, which was obtained almost free from phosphorus. Feeding with proteids containing phosphorus appears to yield better results so far as the putting on of phosphorus is concerned, than feeding with phosphorus-free proteids *plus* inorganic phosphates. W. D. H.

Metabolism during Thymus-feeding. By Theodor Cohn (*Zeit. physiol. Chem.*, 1898, **25**, 507—510).—In the urine of dogs fed on calf's thymus, a crystalline sediment is found, which, on examination, proved to be allantoin. This substance is believed to be the end-link in the series of products from nuclein; possibly it arises from the oxidation of uric acid. In man, no such sediment was found.

W. D. H.

Physiological Relationships of Ammonia, and the Rôle of the Liver in Metabolism. By SERGEI SALASKIN (*Zeit. physiol. Chem.*, 1898, **25**, 449—491).—Arterial blood shows great constancy in the amount of ammonia in it. The blood of the portal vein contains large quantities during digestion (3·5 to 8·4 milligrams per 100 grams of blood); the blood of the hepatic vein contains about the same amount as arterial blood. The alimentary mucous membrane is richer in ammonia after a meal of meat than after one of bread and milk. The lymph during digestion contains less ammonia than arterial blood, whilst the other organs exhibit great variations in the amount they contain. Such observations lend support to the views of those physiologists who believe in ammonia as a precursor of urea. In dogs with an Eck-Pawlow fistula, the ammonia in the blood, brain, and other organs goes up; the amount of urea falls, whilst that of ammonia increases in the urine. Ammonium carbamate is believed to be an important step in urea formation, but whether oxidising ferments play any important part in urea formation is left an open question; it, however, appears evident that the liver is not the sole seat of the process. Some observations on pathological cases in man are recorded which bear out the conclusions arrived at by experiments on animals.

W. D. H.

Changes in the Blood after Removal of the Thyroid. By A. G. LEVY (*J. Pathol. and Bacteriol.*, 1898, **5**, 316—330).—The experiments were made on dogs.

There is reduction in the number of red corpuscles and of hæmoglobin, but this is not very intense or constant; the white corpuscles, on the other hand, are increased, but the numbers from day to day fluctuate considerably. The specific gravity of the blood always diminishes, and the percentage of fibrin is invariably increased. The total solids are lessened, and there appears to be an increase in some non-proteid constituent; the proteids and total nitrogen are diminished. W. D. H.

Absorption of Iron in Man. By G. HONIGMANN (*Virchow's Archiv.*, 1898, **152**, 191—192).—Hoffmann's experiments on animals prove that absorption of inorganic preparations of iron takes place in the intestine. The present observations on a patient with a fistula in the lower ileum, and in whom the large intestine was thus rendered functionless, show, from examination of the intestinal contents during the administration of *ferrum citricum oxidatum*, that Bunge's hypothesis has no foundation, and that the alimentary canal, as far as the ileum has the power to absorb as much, is 0·33 gram of iron in two days. The urine only contained traces of iron. W. D. H.

Iron in the Liver and Spleen. By J. EVERETT DUTTON (*J. Pathol. and Bacteriol.*, 1898, **5**, 331—339).—Histo-chemical and macrochemical examination of museum specimens of liver and spleen from two cases of malaria shows that there is an enormous increase of the iron in these organs in that disease, produced by blood destruction. The following are the figures obtained compared with those obtained by Quincke in normal cases.

		Milligrams of iron per 100 grams of organs.	
		Liver.	Spleen.
Healthy case,	1	30—40	253
,,	2	81	144
Malarial	1	208	1135
,,	2	440	1325

W. D. H.

Phenylic Phosphates in the Animal Body. By Wilhelm Autenrieth and Zoltán von Vamóssy (*Zeit. physiol. Chem.*, 1898, **25**, 440—448).—It is shown that the normal phenylic and chlorophenylic phosphates are so decomposed in the animal body that a decomposition product, a diphenylphosphoric acid of the common formula $OP(OR)_2OH$, is formed. W. D. H.

The Urea-forming Ferment of the Liver. By Otto Loewi (*Zeit. physiol. Chem.*, 1898, **25**, 511—522).—Richet and others have stated that the 'surviving' liver and extracts of the organ are capable of transforming amido-acids into urea. It is difficult to consider that such an action, if it does occur, is a ferment action in the usual sense of that term. Attempts to repeat the experiments with glycocine failed, no urea being formed; there is, however, a formation of a nitrogenous substance, the nature of which is uncertain, but which resembles urea in some of its characters. W. D. H.

Formation of Animal Fat. By W. Lummert (*Pflüger's Archiv.*, 1898, **71**, 176—208).—From the researches of others, it appears probable that animals are not capable of building up fatty tissue from proteids; the following experiments were made to determine the quantity and nature of the fat elaborated by animals from carbohydrates when fed solely on the latter and proteid matter deprived of fat. Each animal was starved until it had lost considerably in weight, in order to deprive the fat-cells of their contents, and was then fed on flesh, rice-starch, casein, and meat-extract. It was found that, although ducks and geese increased considerably in weight on this diet, hardly any adipose tissue was formed; dogs, on the other hand, produced large quantities of fat, which, when examined according to the directions given in Benedikt's "Analyse der Fette und Wachsarten," 3rd edition, 1897, gave values showing that the fats formed consist of the triglycerides of palmitic, stearic, and oleic acids, mixed in similar proportions to those characterising other natural fats. Of special interest is the fact that in the fats elaborated from carbohydrates, neither hydroxy-fatty acids nor alcohols of the fatty series are present.

In the liver, no fat formation appears to take place under the conditions of diet described; the amount of fat corresponded with that present in dogs after long periods of starvation. The substances extracted by light petroleum from the dried liver of the dogs were found to constitute from 4·9—8·7 per cent. of its weight, and to contain from 23·3—34·9 per cent. of cholesterol; the fat formed in the region of the spleen and the kidneys also contains from 13—22 per cent. of cholesterol.

The blood yielded from 0·9—1·15 per cent. of its weight of solid substances soluble in light petroleum, and judging from the acetyl-number, these apparently contain from 54·9—61·3 per cent. of cholesterol; it would appear that their amount is increased by a change from a proteid to a mixed proteid and carbohydrate diet, fat being excluded.

W. A. D.

Formation of Uric Acid. By J. Weiss (*Zeit. physiol. Chem.*, 1898, **25**, 393—397).—On the addition of certain fruits (cherries, grapes, &c.) to the author's diet, the amount of uric acid in the urine diminishes, whilst that of hippuric acid (which normally is only present in traces) increases. Experiments were then made with the individual constituents of fruits, namely, potassium hydrogen tartrate, tannic acid, sugar, and quinic acid, but the last named substance was the only one which produced the rise of hippuric and fall of uric acid. Glycerol and lactic acid gave a negative result; the urine throughout was acid.

W. D. H.

Oxidation of the Stereoisomeric Tartaric Acids in the Animal Organism. By Albert Brion (*Zeit. physiol. Chem.*, 1898, **25**, 283—295).—Pohl (*Arch. exp. Path. Pharm.*, **37**, 411) has shown that tartaric acid is only partially oxidised in the organism of a dog or rabbit, whereas substances such as erythritol, succinic acid, and malic acid, which might be expected to give tartaric acid under the above conditions, are completely decomposed.

The author has made a number of experiments on the oxidation of the isomeric tartaric acids in the organism of a dog, and finds that *l*-tartaric and mesotartaric acids are most completely oxidised, *d*-tartaric acid much less, and least of all racemic acid. It follows, therefore, that racemic acid is not split up into its components during its passage through the animal organism.

A. W. C.

Oxidation Changes produced by Animal Tissues. By Wilhelm Spitzer (*Pfluger's Archiv.*, 1898, **71**, 596—603).—In continuation of previous work, in which it has been shown that the oxidation changes produced by animal tissues and tissue extracts depend on the presence of nucleo-proteids (this vol., ii, 36), it is now shown that this is also true for the conversion of arsenious into arsenic acid.

Hofmeister having advanced the opinion that urea can be formed by oxidation processes, the experiment of attempting to obtain urea by digestion of liver-extracts with various ammonium salts was made, but with negative results.

W. D. H.

Composition of Fish, Crustacea, and Molluscs. By Balland (*Compt. rend.*, 1898, **126**, 1728—1731).—The author has determined the moisture, nitrogen, fat, ash, and extractives in the uncooked flesh of 38 kinds of fish, &c.; the results may be compared with those obtained by Miss Williams (Trans., 1897, 649) in the analysis of cooked fish. It appears that those fish which contain the least amount of water are the richest in fat, whilst those containing the least fat are the richest in nitrogen. Crustacea and molluscs contain, as a rule, both less nitrogen and less fat than fish. N. L.

Composition of Colostrum. By Hugo Tiemann (*Zeit. physiol. Chem.*, 1898, **25**, 363—392).—The colostrum of different cows differs in composition; the specific gravity varies from 1·0299 to 1·0594, and diminishes with each milking; the amount of dry residue varies from 12·83 to 32·93 per cent., but the greatest variation is in the amount of fat present. The nitrogenous constituents diminish, but the sugar increases, with successive milkings. The amount of true albumin is small; the amount of caseinogen is about the same as in normal milk, or higher. The amount of globulin (probably combined with calcium) is from two to four times as much as that of caseinogen; this globulin is not in solution but in suspension, and it coagulates at 72°. It has the percentage composition, C, 49·83; H, 7·77; N, 15·28; S, 1·24; O, 25·88. Serum-globulin contains C, 52·71; H, 7·01; N, 15·85; S, 1·11; O, 23·32. W. D. H.

Abnormal Milk. By R. Greig Smith (*J. Soc. Chem. Ind.*, 1894, **13**, 613—614).—Analyses are given of milk from two different cows, the cream of which could be converted into butter by simply stirring with a stick, without the use of a churn. In both samples, the quantity of fat was slightly less than that calculated by Droop Richmond's formula, although the butter produced had a normal composition. In the ash, there appeared to be a deficiency of potassium and an excess of calcium salts. The fat globules of both samples had an average diameter nearly double that of the globules of milk obtained from the Jersey cow, the maximum diameter being as great as 0·001 inch. The abnormal properties of the milk are probably to be attributed to the size of the fat globules. W. A. D.

Examination of Sheep's Milk, with Special Regard to the East Friesland Breed. By Hermann Hucho (*Bied. Centr.*, 1898, **27**, 391—392; from *Landw. Jahrb.*, 1897, **26**, 497).—Three East Friesland sheep, five, one, and two years old, gave about 205, 105, and 198 kilos. of milk in a year. The average percentage composition of the milk of the three sheep was as follows.

		Sp. gr.	Dry matter.	Fat.	Proteids.	Milk-sugar.	Ash.
I		1·0357	17·47	6·90	5·41	4·35	0·81
II		1·0379	16·79	6·09	5·44	4·47	0·97
III		1·0374	16·45	5·70	5·33	4·55	0·87
I—III	Lowest	1·0319	14·18	4·15	3·90	3·12	0·71
	Highest	1·0440	23·45	10·80	8·93	5·42	1·12

The fat and proteids are thus higher, the milk-sugar lower, than is the case with cows' milk. The colostrum was rich in fat (7—9 per cent.) and proteids. Although the three sheep were selected as patterns, the yield of milk was much less than the amounts often stated to be obtained. After lambing, the sheep only weighed 51·5—56 kilograms, and gave only 3·15—3·45 kilograms of wool, which, however, was not of bad quality.

Merino, Hampshire, and two other varieties of sheep, the milk of which was examined, on a few days gave 40—80 kilos. of milk, reckoned on the whole period of lactation, containing 3·0—4·5 per cent. of fat. N. H. J. M.

Uric Acid Crystals. By Schreiber (*Virchow's Archiv.*, 1898, **153**, 147—151).—Ebstein stated that, after treating crystals of uric acid, or urinary gravel, with dilute alkali, the pigment is removed, and the remaining crystals retain their original form and power of double refraction. They give no proteid reaction. Moritz and Mendelssohn, on the other hand, allege that the crystals have a stroma or substratum of proteid nature.

The present research to reinvestigate the question, undertaken under Ebstein's directions, confirms Moritz's statement that, after dissolving out the uric acid with a solution of lysidine and tannic acid, a 'shadow' of the crystal remains behind, which is optically inactive. The same is true for uric acid crystals artificially crystallised from an albuminous liquid. After the uric acid is purified by repeated recrystallisations, this does not occur. The so-called 'shadow,' however, gave none of the proteid reactions. W. D. H.

Physiological Action of Butyric and β-Hydroxybutyric Acids. By Wilhelm Sternberg (*Virchow's Archiv.*, 1898, **152**, 207—217).—Butyric acid injected intravenously in animals (cats) produces coma, but synthetically prepared β-hydroxybutyric acid does not produce this effect. This acid is optically inactive; that found in diabetics is the optically active acid. This consideration, however, is believed not to militate against the conclusion drawn, namely, that diabetic coma is not due, as Minkowski considers, to β-hydroxybutyric acid; the cause of the coma is stated to be a lessening of the alkalinity of the blood. W. D. H.

The Poisonous Action of Urine. By Adolf Beck (*Pflüger's Archiv.*, 1898, **71**, 560—595).—The convulsions which follow the injection of urine into the circulation are not due to its action on the cerebral cortex, for they arise also in animals in which the hemispheres have been removed. They are probably a symptom of dyspnœa, which is produced by disordered circulation in the bulb.

The principal action of urine is on the heart, which is paralysed; the effect on the respiration is secondary to this.

The toxic agents in the urine are its potassium salts, not ptomaines, as Bouchard thought. The antagonism between the urine of the day and night on which Bouchard lays so much stress in his theory on sleep does not exist. The toxic action of both varieties of urine is the same. W. D. H.

The Experimental Production of "Amyloid" Disease. By N. Krawkoff (*Virchow's Archiv.*, 1898, **152**, 397—398).—The failure of Lubarsch to produce amyloid degeneration artificially in animals is attributed to certain faults in the method he adopted. W. D. H.

Chemistry of Vegetable Physiology and Agriculture.

Progress of Fermentation Chemistry during the Last Decades. By MAX DELBRÜCK (*Ber.*, 1898, 31, 1913—1925).—An historical lecture, tracing the course which has been followed by the chemistry of fermentation during recent years. M. O. F.

Alcoholic Fermentation without Yeast Cells. By HANS ABELES (*Ber.*, 1898, 31, 2261—2267. Compare this vol., ii, 127, 246, 346, and 396).—The author discusses the results of Buchner's experiments on the action of antiseptics, and strong solutions of sugar and glycerol on yeast extract, and the apparent differences noticed in the case of living yeast cells.

The amount of extract obtained from yeast, and the microscopic examination of the press cakes, indicate that not only the liquid portion, but also the protoplasmic contents of the cell are present in the expressed juice. The author accordingly compares the results of experiments on living yeast cells with those on yeast extract containing the same percentage amount of cell-contents, and finds that the inhibiting action of sodium arsenite, chloroform, toluene, and ammonium fluoride is quite similar in both cases. Experiments made with strong solutions of cane-sugar and glycerol also indicate that, in mixtures containing the same percentage amount of cell-contents, the effect of these agents on the activity of yeast extract is the same as that on emulsions of living yeast cells. The author, after discussing other arguments which are supposed to tell against the existence of living protoplasm in the extract, concludes that there is but little difference between the fermenting agents in the living cell and in the extract, and that the activity of the latter is best explained by assuming that it still contains living protoplasm. G. T. M.

Production of Acid by Bacteria in Nutritive Media. By WILLIAM HANNA (*J. Pathol. and Bacteriol.*, 1898, 5, 267—273).—The production of acid is used to distinguish between *Bacterium coli* and *B. typhosus.* In milk, the acid doubtless originates from lactose; both the bacteria named above, however, produce acid. Acid production and curdling of the milk are not necessarily concomitants. In diluted serum to which carbohydrate is added, acid production may also occur. The amount of acidity may be determined by titration, and observations on a large number of micro-organisms are recorded. Of the carbohydrates used, lactose and dextrose appear to be most readily acted on, with the formation of acid. W. D. H.

Microbiology of the Process of Nitrification. By SERGEI WINOGRADSKY (*Centr. Bakt. Par.*, 1896, 2, ii, 415—428, and 449—458).—Burri and Stutzer isolated a nitrate organism which showed relatively luxuriant growth on broth and gelatin, but at the same time lost its nitrifying power. The author's experiments, made with a pure cultivation obtained from Burri and Stutzer, showed that, besides the nitrate organism, another, morphologically very similar, organism was present, which develops in organic solutions. The following conclusions are drawn.

The oxidation of nitrites to nitrates must at present be considered as a strictly specific function, incompatible with the property of decomposing organic, especially highly nitrogenous, matter. This function is not labile, but is inseparable from the vitality of the microbe, the development of which is only possible in conjunction with the oxidation of nitrites. The divergent results of Burri and Stutzer arose from an experimental error, and a nitrate bacillus which thrives on gelatin is at present unknown. N. H. J. M.

Denitrification. By G. Ampola and C. Ulpiani (*Gazzetta*, 1898, **28**, i, 410—438).—The authors have succeeded in isolating two new denitrifying organisms; one, *Bact. denitrificans V*, is obtained from earth, and the other, *B. denitrificans VI*, infects suitable media on exposure to the air.

From the results obtained on cultivating these organisms and examining the products of their action on the medium, the authors conclude that the process of denitrification can be expressed by the equation, $5C_6H_{12}O_6 + 24KNO_3 = 24KHCO_3 + 6CO_2 + 18H_2O + 12N_2$.

W. J. P.

The Nitrate Fungus. By Albert Stutzer and R. Hartleb (*Chem. Centr.*, 1897, ii, 622—623; from *Centr. Bakt. Par.*, **3**, ii, 351—354).—About 89—93 per cent. of nitrogen as nitrites is converted into nitrate by the nitrate-bacteria; carbonates, chlorides, and sulphates are favourable, but calcium chloride is unfavourable, to nitrification. Nitrates are not produced in presence of ammonium salts, but only after the whole of the ammonium salts within reach of the organisms have been converted into nitrites. N. H. J. M.

The Principal Amide of the Sugar-cane. By Edmund C. Shorey (*J. Amer. Chem. Soc.*, 1897, **19**, 881—889).—It has long been known that in many plants a portion of the nitrogen present exists in the form of amides, the amount varying with the life and condition of the plant. Crystalline specimens of an amide, obtained from cane-juice by previous observers, have been assumed to be asparagine, but the author finds that the principal amide of the sugar-cane is optically inactive and is not asparagine, but glycocine; the latter compound has not hitherto been known to occur in plants. Fifteen preparations of glycocine, made from samples of the cane during various stages of growth, indicate that this amido-acid is a normal constituent throughout the life of the plant. Glycocine is most easily distinguished from asparagine by the reaction with hot solutions of alkalis. Even with dilute alkali, asparagine readily evolves ammonia with the production of aspartic acid; glycocine, however, gives no ammonia unless the solution is strongly alkaline, and after the evolution of ammonia has ceased only hydrocyanic and oxalic acids are found in solution.

Since the glycocine of sugar-cane has been mistaken for asparagine, it is possible that its presence may have been overlooked in other plants. Should it occur in the *Gramineæ*, which form the major portion of the food of herbivorous animals, this would help to account for the relatively large quantity of hippuric acid found in the urine of these animals.

Glycocine is probably the form in which nitrogen is conveyed to the growing parts of the sugar-cane, and, as maturity is reached, it is converted into proteids, which again furnish glycocine when a fresh growth takes place. There appears to be in the cane a gelatin, or gelatin-yielding proteid which gives glycocine as a product of decomposition. G. T. M.

The Sugar-cane Amide. By Edmund C. Shorey (*J. Amer. Chem. Soc.*, 1898, **20**, 133—137).—The amido-substance present in the juice of the sugar-cane is glycocine, as with benzoic chloride it gives rise to hippuric acid, which was identified by its analysis, appearance, and solubility. The melting points of the amido-substance and the hippuric acid obtained from it are, however, not given. W. A. D.

Lecithins of Sugar-cane. By Edmund C. Shorey (*J. Amer. Chem. Soc.*, 1898, **20**, 113—118).—On precipitating the proteids of raw cane-juice with cupric hydroxide and filtering, a solution is obtained which yields a chocolate coloured precipitate with sodium phosphotungstate dissolved in dilute sulphuric acid; on triturating the dried precipitate with powdered sodium carbonate, extracting with 95 per cent. alcohol, evaporating to dryness, dissolving in water, and extracting with ether, a wax-like substance is obtained, which appears to be a mixture of several lecithins. On digesting it with barium hydroxide, and decomposing the salts formed with sulphuric acid, oleic acid is obtained, together with palmitic and stearic acids; betaine and choline were also isolated, but it is not yet certain whether they existed free in the original juice, or were wholly produced by the hydrolysis of the lecithins. It appears that phosphotungstic acid precipitates from cane-juice, together with the lecithins, a colouring matter, which contains no nitrogen, and is probably a glucoside.

From the above work, it follows that the method generally adopted of designating as "amide-nitrogen" the difference between the total nitrogen of the juice and the "albuminoid" nitrogen present in the cupric hydroxide precipitate is one liable to considerable error; a large proportion of the so-called amide-nitrogen is attributable to substances present of the type of the lecithins. W. A. D.

Lecithin in Plants. By Julius Stoklasa (*Zeit. physiol. Chem.*, 1898, **25**, 398—405).—From analyses of lupins at flowering time, the conclusion is drawn that the formation of lecithin and proteids depends on photosynthetic assimilation, the chloroplasts working with the energy derived from the sun's rays. The chlorophyll-free cells of fungi form their proteid and lecithin molecules by other processes, concerning which a later communication is promised. W. D. H.

Proteids of Lupin Seeds. By Thomas B. Osborne and George F. Campbell (*J. Amer. Chem. Soc.*, 1897, **19**, 454—482).—Both yellow lupin (*Lupinus luteus*) and blue lupin (*L. angustifolius*) seeds contain very little proteid matter soluble in water. In the case of yellow lupin, the amount is only some 0·37 per cent.; a part of this consists of proteose, and the remainder is either albumin or a globulin readily soluble in very dilute saline solutions. Peptone is not contained in the freshly ground seed, but is formed in small quantity after prolonged contact with water. Yellow lupin seeds yield as much as 26·2 per cent. of proteid matter soluble in saline solutions; this is Ritthausen's conglutin. Preparations from blue lupin are usually much purer than those from the yellow, for the latter contain a considerable amount of some substance containing sulphur, from which conglutin can be separated by fractional precipitation out of dilute salt solutions. This explains why Ritthausen's conglutin from the yellow lupin contained twice as much sulphur as that from the blue lupin. When purified, no difference in properties and reactions can be detected between preparations from the two seeds. The results of a number of analyses gives the following percentage composition. Conglutin from yellow lupin, C = 50·91; H = 6·88; N = 17·93; S = 0·52; O = 23·76. Conglutin from blue lupin, C = 51·13; H = 6·86; N = 18·11; S = 0·32; O = 23·58. Conglutin is readily soluble in sodium chloride solutions containing upwards of 5 per cent. of the salt; on sufficient dilution, it is precipitated, a syrupy liquid separating which is rendered opaque and solid by treatment with water. When dissolved in salt solution, it appears not to be affected by prolonged heating in a boiling water bath, but solutions thus heated, when allowed to cool, form a solid, opalescent jelly, which becomes clear and fluid on further heating. Unlike other globulins, conglutin does not yield insoluble (coagulated) products when washed with alcohol, or when dried.

The lupin meal, which has been extracted with salt solution, yields a small quantity of proteid when exhausted with 0·2 per cent. potassium hydroxide solution. This proteid can be precipitated by adding acetic acid in slight excess, but not by making the solution neutral to litmus. Its percentage composition is, carbon = 51·40; hydrogen = 6·79; nitrogen = 16·43; sulphur = 1·03; and oxygen = 24·35 per cent.

J. J. S.

Proteids of the White Podded Adzuki Bean (Phaseolus radiatus). By THOMAS BURR OSBORNE and GEORGE F. CAMPBELL (*J. Amer. Chem. Soc.*, 1897, **19**, 509—513).—*Phaseolus radiatus* is a small, red bean, cultivated in Japan; its chief globulin is phaseolin, identical with that obtained from the white bean (Abstr., 1896, i, 454). A small quantity of another globulin is also present; this can only be partly removed from its solutions by dialysis into water, but is wholly separated, in a coagulated form, by dialysis into alcohol. The same globulin has also been found in the pea, vetch, and cow pea. Its composition is, carbon = 53·97; hydrogen = 7·01; nitrogen = 16·31; sulphur = 0·88; and oxygen = 21·83 per cent.

J. J. S.

Proteids of the Pea. By THOMAS B. OSBORNE and GEORGE F. CAMPBELL (*J. Amer. Chem. Soc.*, 1898, **20**, 348—362. Compare Abstr., 1896, i, 715).—It has been found that the legumin of the pea is always contaminated with more or less vicilin, a proteid first obtained from the horse-bean, *Vicia faba*. When the vicilin is completely removed, the differences previously noted between the legumin of the pea and that of the vetch disappear, and preparations from these two seeds are identical in composition and reactions. Legumin is not coagulated when its solutions are heated; vicilin, on the other hand, becomes coagulated when its solutions are heated to 95—100°; it is also soluble in a more dilute brine than legumin. Besides these two globulins, two other proteids are present in the pea, namely, *protoproteose*, which is precipitated by the addition of acetic acid to a solution saturated with salt, and *deuteroproteose*, which is not precipitated by acetic acid.

The combined amount of legumin and vicilin obtained by dialysing extracts of the pea is about 10 per cent. J. J. S.

Proteids of the Lentil. By THOMAS B. OSBORNE and GEORGE F. CAMPBELL (*J. Amer. Chem. Soc.*, 1898, 20, 362—375).—Coarsely ground lentils which had been freed from the outer seed coats by a current of air, were ground to fine flour, and the proteids extracted by a 10 per cent. solution of sodium chloride; the clarified and filtered extract being then subjected to fractional dialysis, and precipitation with ammonium sulphate. The products thus obtained were then subjected to careful fractional precipitation from dilute saline solutions, and by this means the same proteids as had been found in the pea (Abstr., 1896, i, 715, and preceding abstract) were obtained, namely, legumin, vicilin, legumelin, and proteose. The amount of the globulins extracted by water is much greater in the case of the lentil than in that of the pea, especially if the acid of the seed is first neutralised by barium hydroxide. J. J. S.

Proteids of the Horse-bean (Vicia faba). By THOMAS B. OSBORNE and GEORGE F. CAMPBELL (*J. Amer. Chem. Soc.*, 1898, 20, 393—405. Compare Ritthausen, Abstr., 1883, 675; 1884, 1405).—In order to avoid contaminating the proteids with tannin, which Ritthausen found to be present in considerable quantity in the skin of the beans, the greater part of the outer coating was removed from the coarsely broken seeds by a current of air, and the remainder by hand picking. The subsequent treatment was the same as in the case of the lentil (preceding abstract). The proteids isolated were the same as in the case of the pea and lentil, namely, legumin, vicilin, legumelin, and proteose.

The amount of these proteids extracted from the seed by water is about 16—18 per cent., the yield being slightly higher when the acid contained in the seed was neutralised with barium hydroxide before extraction; the unneutralised extract, unlike the neutralised, and unlike other extracts of legumes, gave a heavy precipitate with pure sodium chloride. The addition of acetic acid gave a large precipitate soluble in dilute brine; so also did calcium chloride and calcium sulphate.

J. J. S.

Proteids of the Vetch. By THOMAS B. OSBORNE and GEORGE F. CAMPBELL (*J. Amer. Chem. Soc.*, 1898, 20, 406—410. Compare Abstr., 1896, i, 715).—The globulin, previously described, has been further fractionated, and the results indicate that the saline extracts of the vetch contain no other proteids than legumin, legumelin, and a very small proportion of proteose. Vicilin, which occurs in the pea, horse-bean, and lentil, is not present in detectable quantity in the vetch.

J. J. S.

Proteids of the Pea, Lentil, Horse-bean, and Vetch. By Thomas B. Osborne and George F. Campbell (*J. Amer. Chem. Soc.*, 1898, **20**, 410—419. Compare Abstr., 1896, i, 715, and preceding abstracts).—The seeds of the pea, lentil, horse-bean, and vetch contain legumin, legumelin, and proteose; the pea, lentil, and horse-bean also contain vicilin. Full analytical numbers and descriptions of the properties and reactions of these proteids are given. The authors think that legumelin is to be classed with the albumins rather than with the globulins; the amount of legumelin present in the pea is 2 per cent., in the vetch 1·5, and in the lentil and horse-bean 1·25 per cent.

J. J. S.

Proteids of the Soy-bean—Glycine Hispida. By Thomas B. Osborne and George F. Campbell (*J. Amer. Chem. Soc.*, 1898, **20**, 419—428).—Two varieties of soy-bean have been examined, namely, yellow soy-bean and the variety known in Japan as *Kiyusuki diadzu*. The seeds were treated as in previous cases (preceding abstracts). The chief proteid is a globulin somewhat similar to legumin, but of different composition, containing nearly twice as much sulphur, 0·4 per cent. more carbon, and 0·5 per cent. less nitrogen. The authors term this proteid *glycinin*; its composition is: carbon = 52·12; hydrogen = 6·93; nitrogen = 17·53; sulphur = 0·79; and oxygen = 22·63 per cent. It is readily soluble in sodium chloride solutions, and is precipitated by dialysis, by dilution, or by cooling. Solutions containing more than 2 per cent. of sodium chloride dissolve glycinin freely, whilst the solvent power of those containing less salt diminishes more rapidly than the percentage of salt decreases. Dissolved in sodium chloride solution, the globulin is not precipitated by saturating with magnesium sulphate or sodium chloride, but is completely precipitated by saturating with sodium sulphate at 34°. When prepared from carefully neutralised extracts, glycinin is not soluble in pure water; if soy-bean meal is treated with water, upwards of 16 per cent. of the globulin is dissolved, but here the solution is due to the potassium phosphates contained in the seed. Its solution in 10 per cent. sodium chloride is not coagulated by prolonged heating in a boiling water bath. Dilute acetic acid yields a precipitate which is insoluble in excess of sodium chloride solution. The insoluble, so-called albuminate, form of this globulin, like that of legumin, when treated with salt solution, becomes gelatinous, and it is impossible to filter solutions containing even a small quantity of it. In absence of salts, glycinin is readily soluble in very dilute acetic acid, and is precipitated from such solution by sodium carbonate, even before the acid is completely neutralised.

The soy-bean contains a more soluble globulin, which is probably identical with phaseolin. It also contains about 1·5 per cent. of legumelin and a small quantity of proteose.

J. J. S.

Proteids of the Sunflower Seed. By THOMAS B. OSBORNE and GEORGE F. CAMPBELL (*J. Amer. Chem. Soc.*, 1897, **19**, 487—494. Compare Ritthausen, Abstr., 1880, 677; Vines, *J. Physiol.*, **3**, 93).—The meal of the seeds was freed from oil and then extracted with 10 per cent. sodium chloride solution; a quantity of proteid was obtained from this extract by dilution, by dialysis, and also by saturation with sodium chloride. In composition and reactions, this proteid agrees with the globulin edestin, except that a part of it is precipitated by saturating its solutions in brine with sodium chloride; in composition, the part precipitated by saturating with salt and that remaining in solution are alike. As obtained by extraction from the seed, it is probable that the globulin is mixed with some 2 or more per cent. of helianthotannic acid, from which it cannot be completely separated. The authors cannot confirm Vine's statement that, if the seeds are treated with alcohol instead of ether, the globulin contained in them becomes soluble in concentrated salt solution.

J. J. S.

Proteids of the Cow Pea (Vigna Catjang). By THOMAS B. OSBORNE and GEORGE F. CAMPBELL (*J. Amer. Chem. Soc.*, 1897, **19**, 494—500).—The chief proteid of the cow pea is a globulin which the authors term *vignin*; it much resembles the legumin of the pea and vetch, but differs in composition and properties. Its composition is: carbon = 52·64, hydrogen = 6·95, nitrogen = 17·25, sulphur = 0·5, and oxygen = 22·66 per cent. It dissolves in cold or warm water free from dissolved salts, and may be precipitated from such solutions by the addition of a very little sodium chloride. It is readily soluble in saline solutions containing upwards of 5 per cent. of sodium chloride, but very little dissolves in a 1 per cent. solution. It is readily and completely soluble in dilute acids or alkalis in the absence of salts; but solutions in very dilute nitric or hydrochloric acid are precipitated by salt or by excess of these acids. It is much less readily soluble in dilute sulphuric acid, and is not precipitated by an excess of the acid. Dissolved in 0·5 per cent. sodium carbonate solution, the proteid is precipitated by neutralisation. When dissolved in 10 per cent. sodium chloride solution, it is precipitated on the addition of a considerable quantity of hydrochloric or acetic acid; the saline solution deposits the globulin on dilution more readily than do similar solutions of legumin; saturation with sodium chloride does not precipitate vignin, but saturation with sodium sulphate at 34° causes complete precipitation. Solutions in 10 per cent. brine become turbid when heated to 98°, and after continued heating set to a jelly.

In addition to vignin, the cow pea contains a small quantity of a globulin, probably phaseolin, and a third globulin can also be extracted; this is very readily soluble in very dilute salt solutions, and is partly precipitated by dialysis into water, and completely into alcohol. Its percentage composition is: carbon = 53·25, hydrogen = 7·07, nitrogen = 16·36, sulphur = 1·11, and oxygen = 22·21. J. J. S.

Proteids of Bean Flour and Wheaten Flour. By ÉMILE FLEURENT (*Compt. rend.*, 1898, **126**, 1374—1377).—A specimen of bean flour was found to contain 31·04 per cent. of nitrogenous constituents, comprising legumin, 18·92 per cent.; vegetable albumin, 0·20 per cent.; glutenin, 9·52 per cent.; and gliadin, 2·40 per cent. The value of wheaten flour is closely connected with the composition of the gluten, which should consist of glutenin and gliadin in the proportion of 1 to 3, and it is a common practice to improve certain varieties of wheaten flour by adding 2 or 3 per cent. of bean flour. The effect of this admixture is to maintain the proper ratio of glutenin to gliadin, bean flour being especially rich in glutenin, whilst wheaten flour is sometimes deficient in this substance. N. L.

Decomposition of Proteids in Living Plants. By ERNST SCHULZE (*Zeit. physiol. Chem.*, 1897, **24**, 18—114).—During germination, a mixture of nitrogenous compounds, in which aromatic and fatty amido-acids and arginine are probably invariably present, are produced in the decomposition of the proteids, and of the albumoses and peptones formed by the hydrolysis of the proteids. It may be questioned whether asparagine and glutamine are directly produced to any great extent, but this is by no means improbable. These products are to a great extent further decomposed, a portion of the nitrogenous residue (? ammonia) being utilised in the synthesis of asparagine and glutamine and possibly other compounds. The object of this process is to convert the products which are not suitable for producing proteids into material available for this purpose. Whether similar changes take place in plants subsequent to germination remains to be proved. At the same time, there is no evidence against such a supposition.

An examination of alcoholic extracts of etiolated lupin seedlings for amido-acids gave the following results. Seedlings of *Lupinus angustifolius* (6 days) yielded mainly leucine. Eight-day old seedlings furnished about 1 per cent. of amido-acids containing, besides leucine, a certain amount of tyrosine, and probably a little phenylalanine. Seedlings of *Lupinus luteus* (6 days) gave results similar, both qualitatively and quantitatively (as regards total yield), to 8-day old seedlings of *L. angustifolius*, but they probably contained arginine as well.

Estimation of Asparagine.—Finely ground seedlings, mixed with a little calcium carbonate, are extracted with hot water, and the filtrate evaporated to a thin syrup, being filtered a second time during the evaporation. The crystals of asparagine which separate after 1—2 days are washed with cold water and dilute alcohol, dried at 105° and weighed; the mother liquor, &c., are evaporated to a syrup, and the crystals which separate placed on a porous plate, and afterwards crystallised from water. The whole of the crystals are weighed, the weight of the small amount of ash they contain being deducted.

N. H. J. M.

Solution of the Reserve Substances of Grain and Bulbs. By KONSTANTIN A. PURIEWITSCH (*Ann. Agron.*, 1898, **24**, 288, from *Ber. deut. bot. Ges.*, **14**).—When wheat and maize, from which the embryos and scutella have been removed, are kept in contact with distilled water (complete immersion being avoided), the reserve matter of the endosperm is dissolved out and the cells become empty as during germination. When saline or organic solutions are employed instead of water, the emptying of the endosperm is greatly hindered, whilst it is completely stopped by treatment with ether or chloroform.

Lupins, haricots, and bulbs from which the embryos were removed gave similar results. The embryo is, therefore, not essential for the solution of the reserve substances, although it does undoubtedly secrete diastases, which penetrate to the albumen and accelerate its digestion.

Bulbs and cotyledons thus exhausted can be refilled by means of appropriate solutions. This was observed in the case of *Allium cepa*, which, after being kept 6 days in contact with a 5 per cent. solution of saccharose, was found to contain a considerable amount of glucose. With the endosperm of wheat and maize, however, negative results were obtained. N. H. J. M.

Cascara Sagrada. By ALFRED R. L. DOHME and HERMANN ENGELHARDT (*J. Amer. Chem. Soc.*, 1898, **20**, 534—546).—The air-dried powder of *Cascara sagrada* bark, after drying at 110° to constant weight, is shown to contain 8·3 per cent. of moisture. The ash (about 7 per cent.) contains sodium, potassium, aluminium with traces of calcium and iron, together with silicic acid and traces of hydrochloric and sulphuric acids.

On extracting with chloroform in a specially devised apparatus, it gives 7·5 per cent. of a dark greenish-brown oil, a portion of which is volatile with steam. It has a yellowish-green colour and to a marked degree the characteristic odour of the bark.

The residual oil contains neither alkaloid nor glucoside, but on saponification with potassium hydroxide yields a substance crystallising in white leaflets melting at 24—26° and having the composition $C_{12}H_{26}O$. It is probably normal dodecyclic alcohol, which melts at 24° and is present in combination with palmitic and stearic acids.

The residue from the chloroform extract, when treated with alcohol, gives a glucoside crystallising from acetone and ethylic acetate in dark brown-red needles melting at 237°. The authors propose to call this substance *purshianin*. On heating it with alcoholic hydrochloric acid, it yields a sugar and emodin. A. W. C.

Investigation of Soil for the purpose of Judging its Mechanical and Chemical Properties. By KURT BIELER (*Jahrb. agrik.-chem. Versuchs. Stat.-Halle a.-S.*, 1896, **2**, 146—155).—The soils examined were in part those of the experimental station itself, but mostly from elsewhere.

In estimating lime and phosphoric acid, for instance, in samples which have not been subjected to mechanical analysis, the air-dried soil (250 grams) is heated for half an hour on a water bath with 500 c.c. of water, being frequently stirred. The whole is then removed to a 0·2 mm. sieve and washed through with a brush; it is afterwards washed through gauze, and the dust thus obtained analysed. The results are calculated on the weight of air-dried fine sand, the weight of which, as well as of the dust, must be ascertained.

In judging the quality of a soil, the following numbers (per cent.), are used as a basis.

	N and P_2O_5.	K_2O.	CaO in loam.	CaO in sand.
Poor	below 0·05	below 0·05	below 0·10	0·05
Moderate	0·05—0·10	0·05—0·15	0·10—0·25	0·10
Normal	0·10	0·15—0·25	0·25—0·50	0·1—0·2
Good	0·10—0·15		0·50—1·00	above 0·2
Rich	above 0·15	above 0·25	above 1·00	

As regards mechanical analysis, the amounts of soil are determined which are retained by 6, 3, 2, 1, 0·5, and 0·2 mm. sieve, the fine sand, and the dust. The dust is further separated by water into dust-sand and mud.

A large number of analyses are given in tables. N. H. J. M.

Reduction of Nitrates in Arable Soil. By Pierre P. Dehérain (*Ann. Agron.*, 1898, **24**, 130—134).—As bearing on the results of Schneidewind, who found that the pentosans present in straw may serve as food for denitrifying bacteria, an experiment is described in which the effect of adding starch and straw respectively to soil containing nitrates was observed. Whilst the addition of starch caused practically the whole of the nitrates to disappear, only about a third of the nitric nitrogen was lost under the influence of straw. The amount of straw was 1 per cent. of the weight of the soil, a quantity greatly in excess of the weights usually applied in practice. The injurious effect of great quantities of farmyard manure is perhaps due rather to nitrification being checked than to actual loss of nitrates.

It is agreed that fresh farmyard manure, like straw itself, contains denitrifying organisms, but inasmuch as their action is only evident when excessive amounts of manure are applied, it is unnecessary to incur the expense of treating stable-manure with sulphuric acid or superphosphate, either to prevent denitrification in the soil, or to prevent loss of nitrates in the manure itself, since nitrates do not seem to occur in farmyard manure. Application of acid to prevent loss of ammonia is, of course, quite another matter. N. H. J. M.

Changes which the Phosphoric Acid of Superphosphates and of Basic Slag Undergoes in the Soil. By St. Smorawski and H. Jacobson (*Ann. Agron.*, 1898, **24**, 292—293; from *Blatt. f. Zuckerrübenbau*, 1897, 232. Compare Abstr., 1897, ii, 120).—Phosphoric acid (1 and 0·5 per cent.), in the form of superphosphate and basic slag respectively, was mixed with soil poor in phosphates, and extracted during 24 hours with water saturated with carbonic anhydride. The two manures behaved in exactly the same way as in the previous experiments. N. H. J. M.

Alkali Chlorides in the Grapes and Wines of the Province of Oran. By Edmond Bonjean (*Compt. rend.*, 1898, **126**, 1275—1277).—Twenty-eight samples of wine were collected by the author in different parts of the province of Oran, especially in the neighbourhood of the salt lakes, and only 3 were found to contain less than 0·60 gram of chlorine per litre; 15 contained from 0·60 to 1·2 gram, and 10 contained more than 1·2 gram per litre. The maximum amount found was 4·5 gram per litre. There seems to be no general law as to the distribution of the chlorine between sodium and potassium, but both metals were present in each case.

It is evident that great care is needed in forming an opinion as to the purity of a wine from the proportion of chlorine that it contains.

C. H. B.

Mangel-wurzel. By G. PATUREL (*Ann. Agron.*, 1898, **24**, 97—123).—Comparative experiments with different varieties of roots showed that the French roots, probably owing to their greater leaf development, contain a greater percentage of dry matter than other varieties; they also contain the most sugar and proteids.

The relation between the dry matter and the density of the juice is nearly constant (dry matter ÷ density = 2·8), so that the amount of dry matter, and hence the value of a crop, may be estimated by determining the sp. gr. of the expressed juice.

Roots which contain the lowest percentage of dry matter contain the largest amount of potassium nitrate; the French roots are poorest in nitrate, the German roots the richest.

As regards the yield per acre, the German varieties gave the heaviest crops but the smallest amount of dry matter. As a rule, the yield of sugar and proteids follow the yield of dry matter. The relation (sugar + nitrogenous matter) ÷ dry matter is highest in the French varieties. The relation nitric nitrogen ÷ total nitrogen is very variable, from 8 to 17 in French to 35 and 40 in German roots. Six varieties of English roots held an intermediate position in value between the French and German varieties.

N. H. J. M.

Sesame. By AUGUST HEBEBRAND (*Landw. Versuchs-Stat.*, 1898, **51**, 45—81).—The following analyses of sesame seed, (1) white and (2) black East Indian, (3) Levantine, are given.

	Water.	Total nitrogen.	Proteid nitrogen.	Amide nitrogen.	Crude fat.	Free fatty acids.	N-free extract.	Pento-sans.	Crude fibre.	Ash.
1.	5·42	3·63	3·46	0·17	52·75	1·64	6·30	4·69	2·88	5·27
2.	6·50	3·48	2·93	0·55	51·40	1·69	8·44	4·74	1·70	5·45
3.	5·25	3·11	3·04	0·07	56·75	1·58	6·04	4·69	3·71	4·07

The free fatty acids are calculated as oleic acid. The digestible nitrogen is (1) 3·35, (2) 3·13, and (3) 2·86 per cent.; the iodine number (1) 105·5, (3) 102·1.

The free oxalic acid and soluble oxalates were determined by extracting the acids, freed from fat, with water, adding acetic acid, and precipitating with calcium chloride. The phosphoric acid was determined in the ignited precipitate, and the corresponding amount of calcium phosphate deducted.

Insoluble oxalates were determined by digesting the powdered seeds (free from fat), first with a little dilute hydrogen chloride, and then for an hour on a water bath with strong aqueous sodium hydroxide. The filtrate was treated with excess of acetic acid and precipitated with calcium acetate. The precipitate was boiled with dilute acetic acid, ignited, and weighed. A correction was made after determining the phosphoric acid. The following percentage results were obtained. Soluble oxalic acid (1) 0·131, (2) 0·256, (3) 0·080. Calcium oxalate (1) 1·821, (2) 1·229, (3) 0·210.

The white seeds contained 0·7635 per cent. of lecithin, and the following amounts of ash constituents (per cent. in the pure ash).

K_2O.	Na_2O.	CaO.	MgO.	Fe_2O_3 and Al_2O_3.	P_2O_5.	SO_3.	SiO_2.	Cl.
11·85	1·79	35·14	12·88	3·04	30·82	0·89	3·04	0·16

Analyses of sesame oil and cake are also given. The amount of fatty acids in the cake varies with the age of the samples. Cake which had been kept about 2 months contained on the average 80·9 per cent. of acids (in the fat), whilst samples kept for 1 month contained 66·9 per cent. The amount of acid is thus no criterion of the quality of a cake, and a high percentage does not indicate that the cake is old. Cake should not be broken or ground until just before it is used for feeding.

A list of references to other work on the subject is given.

N. H. J. M.

Nitrogen in the Vegetation of Forests. By Ed. Henry (*Ann. Agron.*, 1898, **24**, 138—140; from *Compt. rend. Soc. Sci. Nancy*).—In agricultural soils, there is loss of nitrogen, in the form of nitrates, through removal in crops and in drainage. In the case of forests, there is presumably no loss of nitrates in drainage, since Boussingault, Ebermayer, Bréal, and the author failed to detect nitrates in forest soils. It is probable, however, that nitrification does take place in such soils, but that, as nitrates are produced, they are at once denitrified.

The gain of nitrogen which is known to take place in forest soil is attributed, on the one hand, to fixation of free nitrogen by leguminous plants (broom, gorse, &c.), and, on the other, to fixation by dead leaves.

It was found that when dead oak leaves were kept for a year in boxes exposed to air, the percentage of nitrogen in the dry matter rose from 1·108 to 1·923. Taking into account that there was at the same time a loss of 21·62 per cent. of dry matter, the percentage of nitrogen at the end of the year would have been 1·508, supposing the loss to have been entirely due to decomposition of non-nitrogenous matter. On the assumption that 3300 kilos. of dead leaves fall on a hectare, there would be a gain of 22 kilos. of nitrogen.

Dehérain calls attention to the results obtained by Kostycheff (Abstr., 1891, 611), indicating that the gain of nitrogen is only relative, being due to disappearance of carbonaceous matter. N. H. J. M.

Results of Vegetation Experiments for ascertaining the Manurial Requirements of Soils. By Max Maercker (*Jahrb. agrik.-chem. Versuchs-Stat. Halle a.-S.*, 1896, **2**, 169—173).—In order to ascertain by direct experiment what manures were wanted, white mustard was grown in the soil, in pots, without manure, with nitrogen and phosphoric acid, separately, together, and in conjunction with potash, and with potash and calcium carbonate. The following results, obtained with three samples of soil from a farm which had been much exhausted by the growth of fodder crops, are of interest, as giving clear indication of deficiency of phosphoric acid. The amounts of manure applied were: N, 3·0; P_2O_5, 1·5; CaO, 3·0 grams. The numbers indicate the amount of produce.

	N.	$N+P_2O_5$.	N + CaO.	$N+P_2O_5+CaO$.
1. Heavy loam	18·8	54·3	21·5	55·6
2. Mild „	35·0	67·6	41·0	63·1
3. Sandy „	65·6	58·8	60·4	60·4

Deficiency of nitrogen was not expected, as plenty of cattle were kept. Making allowance for the fact that in pot experiments much greater crops and, in consequence, much greater differences in amounts of produce are obtained than in the field, it may be safely assumed that in the case of soils 1 and 2 an abundant application of phosphates would have a very decided effect. In the case of soil No. 3, there was no indication of a deficiency of phosphates.

Analyses of the three soils showed high percentages of phosphoric acid (0·230, 0·264, and 0·253), which, in the case of the first two, were not at all in accordance with the results of the vegetation experiments. The fact that soil No. 3 contained only about the same amount of phosphoric acid as 1 and 2, whilst, unlike these, it did not show a deficiency in the pot experiments, accords with the author's observation that the phosphoric acid of sandy soils is much more readily available than in loam or clay soils.

Estimation of total phosphoric acid in soil is, therefore, of very limited value; whilst a low percentage indicates a deficiency, a high percentage is no conclusive evidence that available phosphoric acid is not deficient. At present, vegetation experiments cannot be dispensed with. N. H. J. M.

Loss of Ammonia in the Production of Farmyard Manure. By PIERRE P. DEHÉRAIN (*Compt. rend.*, 1898, **126**, 1305—1310).—It has been shown by Berthelot and André that ammonium carbonate dissociates in aqueous solution, the escape of the ammonia being determined and regulated by that of the carbonic anhydride. These results are found to be applicable to the loss of ammonia in the formation of manure, a loss amounting usually to one-third, sometimes to one-half, of the total nitrogen contained in the excreta. Conditions favouring the escape into the atmosphere of the carbonic anhydride formed by the fermentation are accompanied by loss of ammonia, whilst when fermentation takes place in an atmosphere of carbonic anhydride, no loss of ammonia occurs. The author deduces from his observations the following practical rules. The soiled litter should be transferred to the dung-heap as frequently as possible, and the stable gutters flushed with water to carry the liquid excreta into a tank, which also receives the drainings of the dung-heap. The latter should be well heaped up and often watered with the liquid from the tank; an active fermentation is thus maintained, and the constant production of carbonic anhydride prevents the escape of ammonia.

N. L.

Wiborgh Phosphate, a Manure prepared from Gellivara Apatite. By Lars F. Nilson (*Bied. Centr.*, 1898, **27**, 385—390; from *Kongl. landtbruksakad. handl. tidskr.*, 1898, 1—17).—The magnetite found at Grängesberg and Gellivara is, in part, mixed with considerable amounts of apatite. To separate the two substances, the mineral is crushed until grains of about 1 mm. are obtained, and the iron compounds are then separated magnetically. The iron ore then contains about 71 per cent. of iron with very little phosphate, and is very suitable for the Martin process. The refuse contains about 80 per cent. of apatite, the rest being mainly felspar, with some quartz, mica and non-magnetic ferric oxides.

As, at the present time, there is little prospect of this substance being utilised as basic slag, a process, suitable for all crude phosphates, has been proposed by Professor Wiborgh for converting it into manure, which consists in heating the product with sodium carbonate at about 900—1000°. A sample of Wiborgh phosphate thus prepared contained: K_2O, 1·54; Na_2O, 14·69; CaO, 38·12; MgO, 2·88; Fe_2O_3 and Al_2O_3, 4·50; P_2O_5, 27·01; SiO_2, 9·99; SO_3, 0·27; F and loss on ignition, 1·00 per cent. It dissolves completely in hydrochloric acid, but only very slightly in water. The citrate-solubility of the phosphoric acid is readily brought up to 95 per cent. In preparing the phosphate, the best results are obtained with 30 parts of sodium carbonate to 100 parts of apatite, when the latter contains 17 per cent. of felspar. Without felspar, the apatite is much less readily attacked and the product contains much less citrate-soluble phosphoric acid.

A number of pot experiments were made with oats, peas, and sugar beet, in which different amounts of the new phosphate were compared with corresponding amounts of citrate-soluble phosphoric acid in the form of basic slag and superphosphate respectively. In the case of oats, Wiborgh phosphate and basic slag were about equal, and better than superphosphate. With peas, all three phosphates gave about the same amount of grain, but basic slag produced the most straw. As regards sugar beet, the percentage of sugar in the roots was about the same with Wiborgh phosphate as with basic slag, when large amounts were applied. N. H. J. M.

Decomposition of Milk-Fat during the Ripening of Cheese. By H. Weigmann and A. Backe (*Landw. Versuchs-Stat.*, 1898, **51**, 1—14).—Previous results obtained by Henzold and Weigmann showed that, in the ripening of cheese, the greater portion of the milk fat remains unchanged, whilst according to Weidmann (Abstr., 1882, 692) the fat is either not altered at all or only very slightly (compare also Manetti and Musso, *Landw. Versuchs-Stat.*, 1878, **21**, 218). Duclaux concluded that the fat undergoes only a slight change at first, but that subsequently the change is very great, and that whilst at first the change is limited to the glycerides of the soluble fatty acids, the oleic acid glyceride is afterwards attacked (*Principes de laiterie*).

The examination of a number of different kinds of cheese showed that, in the process of ripening, a portion of the fat is decomposed. In cheeses of ordinary ripeness, 1—7 per cent. of the fat consists of non-volatile fatty acids. Of the hard cheeses, the newest ($2\frac{1}{2}$ months) contained the smallest amount of fatty acids, whilst a soft cheese (3 months) was found to contain nearly 7 per cent., indicating that the decomposition depends more on the intensity of the ripening than on the age. There is also an indication that even after $2\frac{1}{2}$ months the decomposition may extend to the glycerides of the non-volatile fatty acids.

The following is the method employed. The cheese, mixed with sand, was extracted with ether, the dry extract purified by dissolving in light petroleum, and again dried at 100° to 105°. The free fatty acids were obtained by exactly neutralising the light petroleum extract, dissolved in ether and alcohol, with N/10 caustic soda, after titrating a portion in order to ascertain the amount of alkali required. Any unchanged fat was then removed by extracting with light petroleum as long as anything dissolved; finally, the alcohol was evaporated, the residue treated with dilute sulphuric acid, and the liquid fatty acids removed from the surface. The acids were weighed, the melting point determined, and in some cases they were titrated with caustic soda. N. H. J. M.

Analytical Chemistry.

Volumetric Analysis: Correction to be applied when an Aliquot Part of a Filtrate is Titrated. By Ruoss (*Zeit. anal. Chem.*, 1898, **37**, 422—426).—In cases where a substance is estimated by adding a known excess of a precipitant, making up to a known volume, filtering through a dry filter, and titrating the excess of precipitant in a portion of the filtrate, the error $(X - x)$ arising from neglecting the volume of the precipitate amounts to $\frac{arx}{1000\,sm - ar}$, where X is the true amount of the precipitate obtained, $x = a(C - r)$, the amount calculated without applying the correction, $a = \frac{\text{equivalent of precipitate}}{\text{equivalent of precipitant}}$, s = sp. gr. of precipitate, m, volume to which the mixture is made up, C, the amount of precipitant used, and r, the excess found, calculated on the total volume m. Since, however, ar is small compared with 1000 sm, it may be omitted from the denominator without appreciable error, and $x + \frac{arx}{1000\,sm}$ is the corrected result. By making $m = 50$ c.c., and using 25 c.c. of filtrate for titration, any error in this operation is only multiplied by 2, and by keeping the excess of the precipitant small, the correction often amounts to only a few tenths of a milligram. M. J. S.

Spectrum Analysis of Minerals. By Arnaud de Gramont (*Compt. rend.*, 1898, **126**, 1513—1515).—The author has applied to a large number of compounds his method of allowing a condensed spark to impinge on a bead of a mineral or precipitate previously powdered and fused with sodium carbonate. Lithium is very readily recognised by means of the red line 6708 and the orange line 6104. Sodium is recognised by the red doublet and the less refrangible green doublet, but potassium is difficult to recognise, the green group K_a and the violet line 4046 being the most distinct. Rubidium is easily recognised by means of the violet lines 4216 and 4202, and cæsium by its blue lines 4593 and 4556.

Barium, calcium, and strontium are particularly easily detected by this method; the first by the red and orange lines 6497 and 6142, the green 5778, 5536, and 4934, and the blue 4554; the second by the blue lines 4455, 4435, 4426, and especially by the violet 4227 as well as the ultra-violet 3969 and 3934; the last by the blue line 4608, the indigo 4306, and the violet 4216. Magnesium under these conditions is characterised by the green triplet Mg_a, beryllium by the blue line 4573, the reaction being less sensitive than with magnesium, manganese by the group of five blue lines Mn_a, chromium by the green triplet 5209, 5206, and 5205. Iron and nickel should not be sought for by this method. Aluminium, however, is readily detected by means of the red doublet 6245, 6235, provided that lithium carbonate is used instead of sodium carbonate. Vanadium shows the strong indigo lines, especially 4408, and zirconium shows five lines in the blue between 4816 and 4690, the line 4740 being the strongest and most persistent.

The author gives the results of the examination of a large number of minerals by this method. C. H. B.

Sterelectrolysis of Minerals. By FRANÇOIS MAYENÇON (*C.R. Assoc. Franç. Adv. Sci.*, 1898 [1897], **26**, [ii], 347—348).—The name sterelectrolysis is given to the following method of analysing minerals. The fine powder is made into a paste with water, placed between two pieces of filter paper, and electrolysed between platinum electrodes with six dichromate cells. Metals or their oxides appear at the cathode, and acid radicles at the anode. For example, with galena, metallic lead and sulphuric acid are obtained, and with barytes, baryta and sulphuric acid. The separated constituents are then identified by ordinary analysis. L. J. S.

Detection of Perchlorate in Chili Saltpetre. By HEINRICH FRESENIUS, and H. BAYERLEIN (*Zeit. anal. Chem.*, 1898, **37**, 501—504).—The authors describe their method of carrying out Behren's test (this vol., ii, 482), and claim that as small a proportion as 0·2 per cent. of perchlorate can be directly detected, thus avoiding the somewhat troublesome concentration by means of alcohol recommended by Breukeleveen. Four to six drops of a concentrated, filtered solution of the substance are placed on a microscopic slide, a few crystals of rubidium chloride are added, and the solution is coloured distinctly pink with permanganate. It is then evaporated over a small flame until a crystalline crust about 4 mm. broad forms round the edge of the liquid, when it is transferred to the stage of a microscope with a magnifying power of 150. Should the proportion of perchlorate be very small, further evaporation will be necessary before the violet-red crystals make their appearance. The paper is illustrated with drawings of the appearance under the microscope.

M. J. S.

Detection of Bromine in Urine. By ADOLF JOLLES (*Zeit. anal. Chem.*, 1898, **37**, 439—440).—The urine (10 c.c.) is mixed with sulphuric acid and excess of permanganate in a narrow-necked flask. A piece of filter paper soaked in a 0·1 per cent. solution of paradimethylphenylenediamine is placed in the neck, and the flask is warmed on the water bath. If bromine is present, the paper acquires a violet colour, passing at the edges through blue into grey and brown. As little as 0·1 milligram is easily detected. Neither chlorine nor iodine (unless in enormous excess) interferes with the reaction.

M. J. S.

Special Cases of the Estimation of Sulphur and of Iodine. By ANTONIO LONGI and L. BONAVIA (*Gazzetta*, 1898, **28**, i, 336—341). —The authors propose the following methods for estimating, in the same solution, sulphur, in the form of sulphites, thiosulphates, trithionates, tetrathionates, sulphides or polysulphides, and iodine, in the form of iodide or iodate.

A. The solution containing sulphur and iodine is made alkaline with potassium carbonate, oxidised with potassium permanganate (the excess of the latter being destroyed by alcohol) acidified with acetic acid, and filtered ; one proportional part of the filtrate is precipitated with barium chloride and the barium sulphate weighed, whilst another is treated with potassium iodide and the iodine titrated with thiosulphate, after acidification with hydrochloric acid. If the solution contains no chlorides, it is treated, after oxidation and filtration, with nitric acid free from nitrous acid at 50—60°, and precipitated with barium nitrate ; after filtering off the barium sulphate, the iodine is determined in the filtrate as before.

B. The solution of sulphur and iodine compounds is oxidised with sodium peroxide, the excess of the latter decomposed, and the iodic acid reduced with zinc dust ; the filtrate may be treated in two ways. *a.* It is acidified with acetic acid, precipitated with barium acetate, and the barium sulphate filtered off after several hours repose at 40° ; the iodine is precipitated in the filtrate with silver nitrate. *b.* It is neutralised with nitric acid, precipitated with silver nitrate, and strongly acidified with nitric acid ; the filtrate from the silver iodide is precipitated with barium nitrate.

The several methods described all gave satisfactory test results.

W. J. P.

Separation of Dithionic Acid from the other Acids of Sulphur. By ANTONIO LONGI and L. BONAVIA (*Gazzetta*, 1898, **28**, i, 341—344).—Salts of sulphur acids of a lower degree of oxidation than sulphuric acid are, with the exception of dithionic acid, oxidised to sulphuric acid in alkaline solution by potassium permanganate or hypobromite ; after the oxidation, the solution is precipitated with barium acetate, and the barium sulphate filtered off and weighed. The dithionic acid in the filtrate is oxidised to sulphuric acid by digestion for several hours with nitrohydrochloric acid or potassium chlorate and hydrochloric acid in presence of barium chloride; the separated barium sulphate is then collected and weighed.

The test analyses are very satisfactory. W. J. P.

Selenium and Tellurium. By EDWARD KELLER (*J. Amer. Chem. Soc.*, 1897, **19**, 771—778).—The precipitation of selenium and tellurium from solutions of the corresponding selenous and tellurous acids by sulphurous anhydride is only complete in the presence of hydrochloric acid. Selenium appears to be completely precipitated only when the solution contains 30 per cent. or more of strong hydrochloric acid of sp. gr. = 1·175, whereas tellurium is completely thrown down from solutions containing 10 per cent. of this acid, but is not completely removed when the percentage of this acid present rises above 60.

The two elements are both precipitated when a ferric salt is added to solutions of selenous and tellurous acids and the iron precipitated with ammonia, but precipitation is only complete when a considerable excess of iron is present.

Selenium may be separated from tellurium by means of ferrous sulphate, which reduces selenous acid completely in acid solution, but has no action on tellurous acid. Selenium cannot be separated from copper by treatment of the mixed sulphides of these elements with sodium sulphide, since the residue left invariably contains some selenium. Quantitative experiments lend some probability to the idea that this precipitate contains copper selenide formed by the action of selenium sulphide on cupric chloride in the presence of hydrogen sulphide, which simply acts as a reducing agent:

$$3CuCl_2 + SeS_2 + 3H_2S = 2CuS + CuSe + 6HCl + 3S.$$

A. H.

Modified Form of Nitrometer for Use in Nitrogen Estimations by the Absolute Method. By HOOPER A. D. JOWETT and FRANCIS H. CARR (*Chem. News*, 1898, **78**, 97).—In this nitrometer the two limbs are continuous below, as in the Schwarz apparatus, but with a three-way cock between them, which can put the measuring tube in connection either with a nozzle or with the pressure tube; the latter when taking readings, the former during a combustion, so that the unabsorbed gas expels potash by the nozzle, which then dips under potash in a dish. The measuring tube is fitted with a side tube for admitting gas at the lower end, and with a two-way cock above for connecting with an outlet for the withdrawal of gas for analysis, or with a funnel for the admission of potash, a gentle stream of which is allowed to flow through the apparatus during a combustion.

D. A. L.

New Method of Estimating Nitric Acid. By E. BOHLIG (*Zeit. anal. Chem.*, 1898, **37**, 498—501).—The proposed method is very suitable for the estimation of nitrates in natural waters. The dry residue from 100 c.c. of the water evaporated in a conical flask, is treated with a few c.c. of concentrated sulphuric acid, and the neck of the flask immediately closed by a caoutchouc stopper, through which pass two short glass tubes of equal length. The other ends of these tubes are similarly fitted into another caoutchouc stopper, which is pushed loosely into the neck of a second conical flask containing a known excess of potassium ferrocyanide in 80—100 c.c. of water, the position of the two flasks being horizontal. The sulphuric acid is then caused to moisten the whole of the water-residue, and as soon as evolution of gas ceases, the stopper is tightened in the neck of the second flask, and the apparatus placed vertically. The liberated nitric and hydrochloric acids (the presence of a sufficient amount of chloride being presupposed or provided for) react with the ferrocyanide thus, $2HNO_3 + 6HCl + 6K_4FeCy_6 = 3K_6Fe_2Cy_{12} + 4H_2O + 6KCl + N_2O_2$. The contents of the flasks are thoroughly mixed by repeatedly inverting the apparatus, so as to allow the liquid in the upper flask to run into the lower one, and when the free chlorine is completely absorbed, the unoxidised ferrocyanide is titrated by permanganate. The organic matter usually present in a water residue reduces permanganate so much more slowly than does hydroferrocyanic acid that it does not interfere with the recognition of the end point. M. J. S.

Laboratory Notes. By W. F. KEATING STOCK (*J. Soc. Chem. Ind.*, 1897, **16**, 107—108).—*Extraction of soluble phosphates from artificial fertilisers.*—The following method is recommended for the analysis. From 20 to 30 grams of the fertiliser is thoroughly shaken, after the addition of 20 to 30 ordinary glass marbles, with from 2 to 3 litres of water in a closed bottle during 3 hours; the liquid is then allowed to clear by subsidence, or if this takes place slowly, is filtered, and an aliquot portion withdrawn for analysis.

Estimation of nitric nitrogen in water analysis.—The following method gives good results, and has the advantage that the copper–zinc couple can be used repeatedly during several months. A 7 oz. wide-mouthed stoppered bottle is nearly filled with copper–zinc prepared in the usual manner, and 100 c.c. of the water to be analysed added; the stopper is then inserted, and the mixture left at 20—25° during 48 hours; after thoroughly shaking the bottle, 50 c.c. of its contents is withdrawn, 200 c.c. of water free from ammonia is added, and the mixture distilled with sodium carbonate according to the ordinary method.

Extraction apparatus.—In this apparatus, the substance to be exhausted is contained in a tube surrounded by the vapours of the boiling solvent; the latter thus acts at its boiling temperature, and consequently, very economical results are obtained. W. A. D.

Estimation of Phosphoric Acid in Superphosphates. By LÉO VIGNON (*Compt. rend.*, 1898, **126**, 1522—1523).—In the analysis of superphosphates, it is customary to estimate separately and directly the quantities of phosphoric acid soluble in water and ammonium citrate solution respectively. The author finds, however, that when the quantity of phosphoric acid soluble in the citrate solution is small, the results are almost invariably too low, even when the precipitation is allowed to go on for several hours. If, however, the aqueous solution and the ammonium citrate solution are mixed, the estimation of the total phosphoric acid in them is accurate. It is therefore recommended to estimate separately the phosphoric acid soluble in water, and the phosphoric acid in the mixed aqueous and ammonium citrate solutions, and to determine by difference the quantity of phosphoric acid soluble in the ammonium citrate solution. C. H. B.

Analysis of Bone Superphosphate. By F. Poquillon (*Chem. News*, 1898, **78**, 3—4).—The usual determinations of the soluble phosphoric acid and the nitrogen are not considered adequate for ascertaining whether the sample is an admixture of ordinary superphosphate and nitrogenous matter, or a genuine bone superphosphate. It is suggested that the amount of fatty matter soluble in carbon bisulphide or in benzene should also be estimated, inasmuch as the proportional relation of that factor to the phosphoric acid is practically constant in bone superphosphates, being 10 to 12 of fat to 100 of phosphoric acid in superphosphates from green bones or degelatinised bones, with fat previously removed by water, and 6·5 to 100 in superphosphates from bones from which the fat has been extracted by benzene, proportions that cannot conveniently be obtained by admixture with ordinary superphosphate when the nitrogen is also taken into consideration. D. A. L.

Estimation of Boric Acid. By Clemente Montemartini (*Gazzetta*, 1898, **28**, i, 344—348).—The author has shown (*Real. Accad. Linc.*, 1889, [iv], **6**), that Gooch's method (Abstr., 1887, 299) is the best for the estimation of boric acid; Thaddéeff (Abstr., 1897, ii, 597) does not quote this paper, and gives a method for determining boric acid which is inconvenient and complicated. Gooch's method is the only direct and convenient one for determining boric acid. W. J. P.

Action of Carbonic Anhydride on Soluble Borates. By Louis C. Jones (*Amer. J. Sci.*, 1898, **5**, 442—446).—Morse and Burton have worked out a process for estimating boric acid based upon the assumption that when a solution of this acid, mixed with excess of barium hydroxide is treated with carbonic anhydride, the excess of barium only is precipitated as carbonate. The author, having made several experiments, finds the process quite untrustworthy, as the barium borate is also partially decomposed.

Carbonic anhydride is capable of entirely displacing the boric acid, even from borax, if the acid is removed as fast as it is liberated. If a borate is boiled with methylic alcohol in a suitable apparatus through which a current of carbonic anhydride is being passed, the residue will, after some time, give no reaction for boric acid, the whole of it having volatilised with the alcohol. L. de K.

Detection and Estimation of Carbonic Oxide in Air in presence of traces of Gaseous Hydrocarbons. By Armand Gautier (*Compt. rend.*, 1898, **126**, 1299—1305. Compare this vol., ii, 535—538).—The air, previously filtered through glass wool and freed from carbonic anhydride and aqueous vapour by means of caustic potash, barium hydroxide, and phosphoric anhydride, is passed successively through two tubes heated in an air bath at 100—105°, and containing respectively iodic anhydride and finely divided metallic copper. The carbonic oxide is oxidised by the iodic anhydride with liberation of iodine, the latter being completely absorbed by the copper, which is weighed before and after the experiment. Each milligram of iodine corresponds with 0·441 c.c. of carbonic oxide. In the presence of hydrocarbons of the ethylene and acetylene series, which also reduce iodic anhydride to some extent, the air, after passing over the heated copper, is passed through weighed tubes of phosphoric anhydride and barium hydroxide to absorb the water and carbonic anhydride formed by the oxidation of the carbonic oxide and hydrocarbons. The tube containing iodic anhydride is also weighed before and after the experiment. The loss in weight of the latter, less the iodine absorbed by the copper, gives the oxygen supplied by the iodic anhydride, and the difference between this and the amount of oxygen corresponding with the water and carbonic anhydride produced, gives the weight of oxygen contained in the carbonic oxide originally present in the air. N. L.

Sources of Inaccuracy in the Estimation of Carbonic Anhydride and Aqueous Vapour in Large Volumes of Air. By Armand Gautier (*Compt. rend.*, 1898, **126**, 1387—1393).—The author's researches on the estimation of minute quantities of carbonic oxide and hydrocarbons in the atmosphere (this vol., ii, 536) have led him to reconsider the question of the preliminary purification of the air from carbonic anhydride and aqueous vapour, and the relative efficiency of caustic potash, barium hydroxide, sulphuric acid, and phosphoric anhydride is discussed in detail. Even after the most careful purification by means of caustic potash, air still retains carbonic anhydride to the extent of about 0·1 c.c. per 100 litres, but this is easily removed by passing the gas through baryta water, or through a tube containing crystals of barium hydroxide slightly moistened with water. Experiment shows that the traces of carbonic anhydride which escape the action of caustic potash are not to be attributed to oxidation of the rubber connections of the apparatus, or to diffusion, through the latter, of the external air.

The removal of aqueous vapour may be effected, with sufficient accuracy for most purposes, by means of sulphuric acid ; 100 litres of air, carefully dried by this reagent, were found to retain only 0·3 to 0·353 milligram of water, as estimated by absorption by phosphoric anhydride. Since, however, sulphuric acid dissolves carbonic anhydride and other gases, it is preferable, in the most exact analyses, to use phosphoric anhydride. Experiments were made with a view of ascertaining whether the volatility of sulphuric acid is an appreciable source of inaccuracy. One hundred and ninety-two litres of air, after being dried with sulphuric acid, and subsequently filtered through glass wool, produced no sensible turbidity in baryta water, but the latter, on evaporating with hydrochloric acid and taking up the residue with water, left 0·1 milligram of barium sulphate, corresponding to 0·00022 milligram of sulphuric acid per litre of air, a quite insignificant proportion. It is calculated, from this result, that the vapour pressure of sulphuric acid at 13—14° does not exceed one twenty-millionth of an atmosphere. N. L.

Table for Calculating Potassium Platinochloride into Potassium Oxide. By Göltschke (*Zeit. anal. Chem.*, 1898, *supp.*). —This table gives the weight of potassium oxide equivalent to potassium platinochloride for every half milligram of the latter up to 1 gram. The coefficient 0·19308 was used in the calculation.

M. J. S.

Estimation of Calcium. By MAX PASSON (*Zeit. angw. Chem.*, 1898, 776—777).—The advantage of this process is that it may be used in the presence of iron, alumina, magnesia, and phosphoric acid without their previous removal.

The sample is boiled with dilute nitro-hydrochloric acid in a half-litre flask until everything but the sand is dissolved. When cold, the liquid is made up to the mark, and an aliquot part is slightly over-neutralised with dilute ammonia, using phenolphthalein as indicator; a 10 per cent. solution of citric acid is then added until the precipitate has completely redissolved, and after that another 10 c.c. of the citric acid solution. The liquid, diluted to about 200 c.c., is heated to boiling, precipitated with ammonium oxalate, and the precipitate, which is crystalline, is collected, washed, ignited, and weighed as calcium oxide. The test analyses show the great accuracy of the process. L. DE K.

Cyanometric Estimation of some Metals. By HARRY BREARLEY and HORACE JERVIS (*Chem. News*, 1878, **78**, 177—179, 190—191. Compare this vol., ii, 258).—In adopting this method, to ensure uniformity, either direct titration, or adding excess of cyanide and titrating back with silver nitrate should be exclusively adopted, moreover, the quantity of potassium iodide present affects the changes, and should be regulated; 2 c.c. of a 2 per cent. solution for each 500 c.c. of solution titrated gives the deepest desirable cloudiness.

Nickel and copper present contrasts in their behaviour in this process; nitrates, acetates, tartrates, and sulphates in alkaline solution interfere in the case of copper, but not in that of nickel; with the latter metal, too, the reaction is complete with the theoretical quantity of cyanide, whilst with the former metal a great excess is required. In titrating nickel, an error may arise by the formation of a silky, crystalline compound, which is, however, prevented by the use of ammonium sulphate. Various experiments show that chromic oxide, aluminium, zinc, and iron interfere to a noticeable extent with the estimation of nickel by this method, zinc raising, the others lowering, the result, whereas calcium, barium, strontium, magnesium, cadmium, manganese, chromic acid, tin, molybdenum, arsenic, antimony, bismuth, lead, uranium, and tungsten do not interfere. This is true when the amount of nickel is 0·1 gram, the amount of interfering metal 0·05 and 0·1 gram, and the excess of ammonia 10 c.c. of 2N solution, the foreign element being generally added as chloride, and ammonium chloride replacing the sulphate where insoluble sulphates would be formed. The interference of *zinc* decreases with increased excess of ammonia, and may be obviated by adding the cyanide to a faintly acid or neutral solution, and using sodium carbonate instead of ammonia; then filtering, adding silver nitrate to the filtrate until only traces of free potassium cyanide remain, then repassing through the same filter and completing the filtration; if cadmium is present in quantity sufficient to interfere, the same method should be used. Whilst recognising the utility of sodium pyrophosphate as a corrective in the case of zinc, the authors consider that the benefit observed is due to the low results arising from this corrective compensating the high result due to the zinc (Moore, Abstr., 1889, 1033) and, as Moore found with iron, the authors find with aluminium, that sodium pyrophosphate is not a good reagent to use for preventing precipitation; it is, however, useful for the purpose in the case of copper titrations. Tartaric acid may be used to keep aluminium in solution, 0·1 gram of this metal requiring 1 gram of the acid, a large quantity of which, however, delays the reaction. In the presence of *aluminium*, the titration of nickel may be accurately effected by proceeding as in the presence of zinc, but adding the usual excess of ammonia, and not sodium carbonate, filtering an aliquot portion of the liquid, and going back with silver nitrate; a preliminary quantitative test, or some knowledge of the amount of nickel present, is necessary. In the case of *iron*, the low result is due to mechanical retention of the nickel by the precipitate, and is overcome by adding the cyanide before rendering the solution alkaline, or by using an alkali carbonate instead of ammonia for precipitation. If any interference is anticipated on account of *manganese*, the treatment as in the case of zinc may be followed, using ammonium carbonate, or ammonium chloride may be used to keep the manganese in solution, but, as a matter of fact, the precipitated manganese hydroxides are harmless. In the presence of *chromium*, the direct titration of nickel is inadmissible; but with a knowledge of the approximate amount of nickel present, adding excess of cyanide, allowing some time to elapse and then titrating back, it yields fairly accurate results; better still, the excess of cyanide may be added before making the solution alkaline. The mixed solution of chromium and nickel salts, when neutralised, changes from greenish-blue to full green, the blue is restored by a drop of hydrochloric acid and the titration proceeded with; sometimes a precipitate forms before all the cyanide is added, if small it does not interfere. Chromic oxide salts may be rendered harmless by transforming them into chromates, and using ammonium sulphate to retain any basic nickel chromate in solution. *Tin* should be in the stannic form. In the presence of *sodium molybdate*, the titration should not be delayed, inasmuch as a nickel molybdenum precipitate forms very slowly; its formation may be further retarded by using ammonium sulphate. For similar reasons, the titration should not be delayed in the presence of *arsenic*; sodium arsenite lowers the results, but only by less than 1 per cent.; with the arsenate, however, the results are accurate. *Antimony* and *bismuth* oxychlorides do not interfere, but their precipitation may be prevented by means of a small amount of tartaric acid. *Lead* acetate does not interfere, and precipitation may be avoided by using nitrates instead of sulphates to heighten the iodine turbidity. *Uranium* forms a precipitate with ammonia, so that the carbonate should be used. Citric acid causes low results, and cannot be used to replace tartaric acid. It is noted that adding the cyanide to the slightly acid solution does not occasion any serious loss; moreover, experiments indicate that the interference in the cases of chromium, aluminium, and iron appears to be due to mechanical retention. The case of manganese and copper is to be investigated. D. A. L.

Volumetric Estimation of Lead, Copper, Iron, Potassium Ferrocyanide, Dextrose, and Sulphuric Acid (in Sulphates). By Ruoss (*Zeit. anal. Chem.*, 1898, **37**, 426—436).—The operations are best performed in test-tubes of about 120 c.c. capacity. The lead to be estimated is thrown down as sulphate, or ferrocyanide, by an excess of sodium sulphate or potassium ferrocyanide. After boiling and cooling, phenolphthalein is added, and the liquid is accurately neutralised in the cold. It is then heated to boiling, and standard barium hydroxide solution is run in from a burette until the red colour of the upper liquor does not disappear on boiling and is not increased in intensity by further additions. The red colour becomes permanent when half of the lead salt is converted into oxide, but it is better to add a few c.c. in excess and titrate back with N/5 acid, Conversely, sulphates and ferrocyanides are estimated by precipitating with lead nitrate and titrating the precipitate with baryta as above, after filtering and washing, if any metals precipitable by baryta are present.

Chromic acid may be estimated by precipitating with an excess of lead and titrating the lead in an aliquot part of the filtrate, correcting if necessary for the volume of the lead chromate (see this vol , ii, 635). For the estimation of copper, sodium oxalate is added until the copper oxalate first precipitated is redissolved, and then phenolphthalein and baryta. As soon as the free acid is neutralised, the solution acquires the colour of methyl-violet 6B. By adding calcium chloride, the double oxalate is decomposed, and now the red colour of the indicator does not appear until the copper is precipitated. A small excess of baryta is employed as in the case of lead, and the excess of alkali is titrated back with acid, but in this instance at the boiling point. Small quantities of copper can be estimated by precipitating as ferrocyanide, and titrating with baryta; the red colour appears when half the copper ferrocyanide is converted into oxide. The subsidence of all the ferrocyanide precipitates is greatly promoted by adding solid potassium nitrate and boiling.

A modification of the above method serves well for ascertaining the amount of cuprous oxide obtained in a sugar estimation. After proceeding as prescribed by Allihn, but with the sugar solution diluted 2½-fold, the precipitate with its filter is thrown into a test-tube, dissolved in the smallest possible quantity of nitric acid, and the solution boiled for 3 minutes. Soda solution (free from carbonate) is then added until (with phenolphthalein) there is a decided excess of alkali, which excess is then exactly removed by dilute sulphuric acid. To the still hot solution, 15 c.c. of N/2·5 sulphuric acid is added, together with methyl-orange, and after cooling, the excess of free acid is measured with N/5 soda. The greenish-yellow colour which indicates the termination of the titration can be very sharply recognised.

Ferric ferrocyanide, which has been washed with potassium nitrate solution until free from acid, can be titrated with baryta and phenolphthalein, the red colour appearing when all the iron is as hydroxide.

M. J. S.

Separations of Aluminium [from other Metals] by Hydrochloric Acid. By Franke S. Havens (*Amer. J. Sci.*, 1898, **6**, 45—48). —The author (Abstr., 1897, ii, 232) has published a very good process for separating aluminium from iron and beryllium, based on the fact that its chloride is insoluble in a mixture of hydrochloric acid with its own volume of ether previously saturated with hydrogen chloride.

He now states that this process works equally well with mixtures of chloride of aluminium with chlorides of zinc, copper, mercury, and bismuth.
L. DE K.

Condition of Oxidation of Manganese Precipitated by the Chlorate Process. By FRANK A. GOOCH and MARTHA AUSTIN (*Amer. J. Sci.*, 1898, [iv], 5, 260—268).—The authors' experiments show that if due attention be paid to details, the precipitation of manganese nitrate by sodium chlorate in presence of concentrated nitric acid is practically complete, the manganese escaping precipitation being found in no case to exceed 0·0001 gram. The use of sodium chlorate is to be preferred to that of the potassium salt, since the latter, owing to its sparing solubility, is apt to be mechanically carried down with the precipitated oxide; sodium chlorate also has the advantage of being more easily decomposed. The "oxygen value" of the precipitated oxide is best determined by dissolving it in sulphuric acid and potassium iodide solution, and titrating the liberated iodine with standard sodium thiosulphate solution; or by reducing the oxide with N/10 arsenious acid solution in presence of sulphuric acid, neutralising the solution with potassium hydrogen carbonate, and titrating the excess of arsenious acid with standard iodine solution. In the latter process, sufficient tartaric acid or alkali tartrate should be added to the acid solution to prevent the precipitation of manganese during the subsequent neutralisation. If this precaution is not taken, errors may be introduced owing to the reoxidation of the precipitated manganous carbonate by the iodine. A series of analyses made by the methods just described showed that the precipitate obtained in the chlorate process contains less oxygen than corresponds with the degree of oxidation of manganese dioxide, and that the average error thus introduced into analyses based upon the assumption that MnO_2 is precipitated amounts to more than 2 per cent. The oxide may, however, be obtained of a definite and constant composition by a modification of the process, based upon the observation of Wright and Menke that by the action of a dilute solution of potassium permanganate, in presence of zinc sulphate, on manganous sulphate at 80°, an oxide is precipitated which, although combined with alkali, contains oxygen exactly in the proportion corresponding with the dioxide. Three-fifths of the manganese in the precipitate represents the amount originally present in the manganous sulphate. The following method of procedure is recommended.

The solution of the manganous salt is evaporated to dryness, heated with nitric acid until oxides of nitrogen are no longer evolved, and concentrated nitric acid then added until the volume of the liquid is 85 c.c. Sodium chlorate (5 grams) is added, the liquid boiled for 5 minutes, more nitric acid (15 c.c.) and a few crystals of the chlorate introduced, and the solution again boiled. After cooling, the precipitate is collected on an asbestos filter, washed with water, dissolved in 2 c.c. of hydrochloric acid, and the solution evaporated with 5 c.c.

of concentrated sulphuric acid until the hydrochloric acid is completely expelled. The solution of the manganous sulphate (containing not more than 0·5 gram of the salt) is nearly neutralised with potassium carbonate, mixed with solutions of zinc sulphate (2 grams) and potassium permanganate (1·5 grams), and the liquid, amounting to about 500 c.c., heated to 80°, and potassium hydrogen carbonate added in quantity rather more than sufficient to neutralise the acid still remaining. The precipitate is collected, washed with water, and its oxygen value determined by one or other of the methods described above. The results obtained by this process are very satisfactory. N. L.

Estimation of Manganese as the Sulphate and as the Oxide. By Frank A. Gooch and Martha Austin (*Amer. J. Sci.*, 1898, **5**, 209—214).—The authors state that the best way of estimating manganese is to weigh it in the form of anhydrous sulphate, provided it is not heated to too high a temperature.

In their experiments, the solution of the manganous chloride was introduced into a weighed platinum crucible, and after adding a slight excess of sulphuric acid, the water was removed by heating on the water bath. The crucible, supported by a porcelain ring, was then inserted in a porcelain crucible in such a manner that there was a space of about 1 cm. between the platinum crucible and the outer crucible, the latter being heated over a strong bunsen flame until the contents of the inner crucible were quite dry. The results quoted prove the accuracy of the process.

If it is desired to weigh the manganese as manganosomanganic oxide, the residue should be treated with nitric acid, and the crucible heated in the upper part of the flame of a strong bunsen burner, in such a manner that an oxidising flame covers nearly the entire wall of the crucible. For accurate work, the weighing as sulphate is, however, preferable. L. de K.

Estimation of Manganese separated as Carbonate. By Martha Austin (*Amer. J. Sci.*, 1898, **5**, 382—384).—The author confirms the statement of Guyard, that manganese may be completely precipitated by ammonium carbonate even in the presence of excess of ammonium chloride. Precipitated in this manner, the solution being heated to boiling, the precipitate is, of course, quite free from alkali salts, and may be converted by ignition into oxide, or, better still, weighed as sulphate (see preceding abstract). Attempts to weigh the carbonate as such were unsuccesful. L. de K.

Volumetric Estimation of Iron in Hydrochloric Acid Solution by means of Potassium Permanganate. By M. Hauffe (*Chem. Zeit.*, 1897, **21**, 894—895).—The following reagents are required. A solution of potassium permanganate representing about 0·005 gram of iron per c.c.; an acid solution of manganous sulphate, made by dissolving 100 grams of the crystallised salt in 1300 c.c. of water and adding 200 c.c. of sulphuric acid; a cold saturated solution of mercuric chloride, and a dilute solution of stannous chloride.

The substance is dissolved in hydrochloric acid; any insoluble matter is, if necessary, fused with potassium sodium carbonate, and the melt is then again boiled with hydrochloric acid. To completely destroy organic matter, the liquid is mixed with potassium permanganate and thoroughly boiled. When cold, the whole is made up to a definite bulk, and an aliquot part is taken for the titration. This is diluted to about 200 c.c., boiled, and stannous chloride added until the iron is completely reduced, any great excess being avoided; 100 c.c. of the mercury solution is now added, which should give a small but decided precipitate of calomel, and then 60—100 c.c. of the manganese solution. The liquid is rapidly cooled and titrated with the permanganate; the latter should be standardised in the same way, using pure iron wire for that purpose. L. DE K.

Determination of the Reducibility of Iron Ores. By JOHAN G. WIBORGH (*Chem. News*, 1898, **78**, 4—6). Compact ores are less readily reduced by the carbon and carbonic oxide in the blast furnace than other ores, and the peroxide of iron is more easily reduced than less oxidised ores. As ordinary chemical analysis does not indicate how an ore will behave in the blast furnace, the author has devised an apparatus to test this factor. In it a vertical reduction tube, 1·6 metres long and 50 mm. in diameter, with a portion 35 mm. in diameter at the bottom, is suspended, 0·25 metre from the hearth, in a circular producer in which charcoal is burnt in a grate without forced draught. The temperature in this tube varies from 400° at 0·5 metre to 880° at 1·5 metres from the top, whilst the gas produced contains from 3·2 to 3·6 per cent. of carbonic anhydride and 30 to 32 per cent. of carbonic oxide, but when the tube is raised by 0·35 metre from the furnace there is 17 per cent. of carbonic anhydride. In this apparatus, reduction tests may be made by exposing samples of pulverised ore to high temperatures, gradually or suddenly, and in any quantities, but conveniently 8 to 10 grams in a wire gauze boat; one or many at a time may be tested. The author's practice is to suspend the boat in the 400° zone, the zone of dissociation of the reducing gas, for an hour, then to lower it directly into the hottest part of the tube, and after an hour to cool it in a current of carbonic oxide. In the product, the carbon, total iron, and metallic iron are determined, and also the proportion (in units per cent.) that the oxygen found after reduction bears to the amount of oxygen that would be found if the whole of the iron was present as peroxide, the last factor being called the degree of oxidation. The carbon is determined in Särnström's apparatus by oxidising with chromic solution and absorbing the carbonic anhydride; the metallic iron by treatment with sulphuric acid and measuring the hydrogen evolved; the total iron by dissolving 0·25 gram in hydrochloric acid, filtering, evaporating with sulphuric acid, dissolving in water, reducing with zinc, and titrating; the degree of oxidation by treating 0·4 gram of the sample with 5 c.c. of 10 per cent. sulphuric acid with agitation until the evolution of gas ceases, then warming with about 5 c.c. of sulphuric acid, sp. gr. = 1·23, until all the iron is dissolved, and titrating the solution with permanganate. In the case of refractory ores, the first solution is separated and the undissolved residue alone treated with a more concentrated acid, the solutions being mixed for the titration. The numbers obtained by these various iron determinations furnish data for the calculation of the degree of oxidation, which for iron peroxides is 100; for the magnetic oxide, 88·9; and for the suboxide, 66·7. D. A. L.

Separations with Alkali Chromates. By HARRY BREARLEY (*Chem. News*, 1898, **78**, 14—16. Compare this vol., ii, 460).—*Separation of Iron and Aluminium.*—In solutions saturated with dissolved hydroxide, or in hot solutions containing free acetic acid, 0·5 gram of iron is precipitated by 10 c.c. of a solution containing 12·5 grams of potassium chromate per litre, whereas in the first case aluminium is only partially precipitated by 50 c.c. of the chromate solution, and in the second case it is not precipitated at all; when, however, both metals are present in a solution, the iron is only precipitated by a much larger quantity of chromate and carries aluminium with it, so that the reaction cannot be adopted as a means of separation; this appears to be due to the fact that ferric chloride dissolves freshly precipitated basic aluminium carbonate, and aluminium chloride dissolves freshly precipitated ferric hydroxide. In solutions where only the free acid of a solution of iron and aluminium salts has been neutralised without forming dissolved hydroxide, the aluminium is not precipitated at all by the chromate, whilst the iron is only imperfectly precipitated. The *separation of iron and chromium* can also not be effected in solutions saturated with hydroxide. The *separation of iron and nickel* in such solutions by means of potassium chromate is good in the absence of acid, and practically perfect in the presence of 1 per cent. of acetic acid, and inasmuch as a large excess of the precipitant may be used without injurious effect, the separation is good even in the presence of aluminium, which latter may be retained in solution by tartaric acid in the subsequent cyanometric estimation of the nickel, a point, however, to be considered later by the author; but in preparing the solution for this estimation it is necessary in the presence of chromic acid to add ammonium sulphate first, and then to render alkaline with ammonia. The ammonium sulphate prevents the formation of a basic nickel chromate and also heightens the silver iodide turbidity. *The separation of iron and copper* by the chromate is even better than in the case of the nickel, and in both instances the chromate surpasses the acetate separation. The separated copper may be easily estimated by the soda-cyanide process (this vol., ii, 140, 258). D. A. L.

The Iodometric Estimation of Molybdenum. By FRANK A. GOOCH and JOHN T. NORTON, jun. (*Amer. J. Sci.*, 1898, **6**, 168—175).—Friedheim and Euler having taken exception to the criticisms passed on their process by Gooch and Fairbanks (Abstr., 1897, ii, 76), the authors state that, unless precautions are taken to exclude air, the results cannot be trustworthy. The apparatus is made by sealing a separating funnel on to a 100 c.c. Voit distilling flask; this is in turn connected with a Drexel wash-bottle, placed in cold water and containing solution of potassium iodide. To prevent even the slightest escape of iodine, it is fitted with a bulbed trap. About 0·3 gram of the molybdic acid and 0·75 gram of potassium iodide having been introduced into the distilling flask, the air is expelled by means of a current of carbonic anhydride, generated in a Kipp's apparatus from marble and hydrochloric acid containing some cuprous chloride. Forty c.c. of hydrochloric acid of 1·12 sp. gr. is then introduced by means of the separating funnel, and the whole is gently boiled in a current of the gas until exactly 10 c.c. of liquid is left in the distilling flask, when it may be assumed that the last traces of iodine have been expelled. The liberated iodine is then titrated with standard solution of sodium thiosulphate as usual. L. DE K.

Estimation of Technically Available Molybdenum in Molybdenite. By HUGO BORNTRÄGER (*Zeit. anal. Chem.*, 1898, **37**, 438).—About a gram of the mineral is digested (in a conical flask), for about 2 hours, with 25 c.c. of concentrated nitric acid; ammonia is then added, and the liquid filtered. The undissolved portion is treated with acid a second time, and the united filtrates evaporated to dryness with excess of nitric acid; the residue, consisting of molybdic acid and ammonium nitrate, is then treated with 50 per cent. alcohol, in which the latter alone dissolves. The molybdic acid may be collected and weighed, or better, dissolved in 50 c.c. of normal ammonia, and the excess of ammonia titrated back with normal sulphuric acid. The metallic molybdates in the ore, which are technically useless, escape estimation. M. J. S.

Patera's Method of Estimating Uranium. By HUGO BORNTRÄGER (*Zeit. anal. Chem.*, 1898, **37**, 436—437).—The method, as given in Fresenius's *Anleitung zur quantitativen Analyse*, consists in dissolving the ore in nitric acid, adding an excess of sodium carbonate, boiling, and filtering, by which means the uranium passes into the filtrate with only traces of other metals, and can be thrown down by sodium hydroxide as sodium uranate. This method gives fairly accurate results with rich ores, such as pitch blende, but when applied to poor ores the precipitate is liable to be seriously contaminated with silica. It is therefore advisable to dissolve it in hydrochloric acid (after igniting) and to precipitate the uranium by ammonia from the filtrate. This precipitate is more easily washed than that with soda, and after ignition is weighed as Ur_3O_4. M. J. S.

Estimation of Tin in Tin Salts. By A. FROENKEL and J. FASAL (*Chem. News*, 1898, **78**, 100—101).—The solution of the tin salt containing 0·2 to 0·4 gram of metal is treated in a flask with a few drops of hydrochloric acid along with from 0·5 to 1 gram of aluminium wire and gently heated. In about half an hour, when the tin is all precipitated, both metals are completely dissolved by heating with 10 c.c. of concentrated hydrochloric acid; the solution is rendered alkaline by sodium hydrogen carbonate and Rochelle salt, and then titrated with iodine. The results are low. D. A. L.

Detection of Bismuth. By EGIDIO POLLACCI (*Gazzetta*, 1898, **28**, i, 391—394).—Bismuth compounds containing bromine or chlorine colour the bunsen flame bright green; the iodide, oxide, or other bismuth compounds do not give this colour. W. J. P.

Analysis of Soils. By MAX PASSON (*Zeit. angw. Chem.*, 1898, 777—781).—The author has slightly modified the process recommended by Dyer (Trans., 1894, 115), and operates as follows: 120 grams of the dry soil is introduced into a litre flask containing 600 c.c. of a 2 per cent. solution of citric acid, and after the lapse of half an hour it is shaken for half an hour in a Wagner's apparatus. The liquid is then filtered and 100 c.c. is taken for the estimation of the potassium. This, after adding a few drops of phenolphthalein, is mixed with a slight excess of barium hydroxide, which precipitates the greater part of the citric acid; basic lead acetate may also be used, but baryta is better. The excess of barium, or lead, is precipitated by ammonium carbonate, and the liquid is then made up to 250 c.c.; 100 c.c. of the filtrate, representing 8 grams of the soil, is evaporated in a platinum dish, the residue incinerated until the carbon is almost entirely burned away, and then powdered and boiled with dilute hydrochloric acid, the whole being evaporated to dryness. After gently igniting the residue, it is dissolved in water, filtered, and precipitated as usual with platinic chloride.

Lime is best estimated by treating the earth in a litre-shaking flask for half an hour with 500 c.c. of standardised hydrochloric acid containing about half a per cent. of hydrogen chloride, and titrating an aliquot part with soda, using phenolphthalein as indicator.

L. DE K.

Contributions to Forensic Chemistry. [Detection of Phenol, Benzaldehyde, Carbon Bisulphide, Picrotoxin, Coniine and Nicotine]. By H. MELTZER (*Zeit. anal. Chem.*, 1898, 37, 345—358). —*Detection of Phenol and Benzaldehyde.*—On heating to boiling an aqueous solution containing both phenol and benzaldehyde mixed with twice its volume of concentrated sulphuric acid, it becomes deep red, and (if not too dilute) gives a red, resinous deposit. On adding potash (after cooling) to alkaline reaction, the resinous substances dissolve with fine violet-blue colour, and if the liquid, after acidifying, is shaken with ether, the colouring matter dissolves in it; on evaporation, a residue is left which dissolves in dilute alcohol and is coloured blue by alkalis, but is colourless in presence of free acids. Half a milligram of phenol and one drop of benzaldehyde suffices for the reaction.

Detection of Carbon Bisulphide.—Carbon bisulphide, treated with alcoholic potash, is converted into potassium xanthate, which, when boiled for a short time with ethylic iodide, yields diethylic thiocarbonate; as this, when boiled with ammonia, splits up into ethylic thiocarbamate and mercaptan, the latter by its odour affords a means of recognising carbon bisulphide, even when no more than two milligrams is present. The ethylic thiocarbamate can also be recognised, since on boiling with alcoholic potash it is converted into potassium thiocyanate which can be detected by its reaction with ferric salts.

Another method consists in passing the vapour of carbon bisulphide along with carbonic anhydride over fused potassium cyanide, which is thereby converted into thiocyanate. A tube containing lead acetate should be inserted in the series to arrest any hydrogen sulphide. Five milligrams of carbon bisulphide can be detected in this way, but the method is, of course, open to the objection that all volatile sulphur compounds produce the same result.

Detection of Picrotoxin.—A trace of picrotoxin treated with benzaldehyde (diluted with its own volume of alcohol to diminish the yellow colour which it gives with the sulphuric acid) and a drop of concentrated sulphuric acid acquires a red colour, which, on gentle stirring, forms red streaks through the liquid.

Detection of Coniine and Nicotine.—An alcoholic solution of coniine mixed with carbon bisulphide acquires a yellow colour, nicotine gives no coloration. On adding to the yellow solution a few drops of a dilute solution of copper sulphate (1 : 200) or ferric chloride, characteristic yellow to brown precipitates are produced; nicotine gives no such precipitate, although with larger quantities of the metallic salts it yields feeble yellow colorations. The brown copper precipitate is completely removed by ether (after adding water). Lobeliine, aniline, and methylamine give feeble yellow colours with carbon bisulphide, but whereas these colours are no longer visible at dilutions of 1 : 500, coniine gives a distinct reaction at a dilution of 1 : 10,000. On dissolving a trace of nicotine in epichlorhydrin and heating to boiling, a deep red coloration is produced, whereas coniine gives no coloration; about 0·00025 gram of nicotine can be thus detected. Strong solutions of lobeliine give a similar colour, but dilute solutions give only a feeble yellow. Aniline, dimethylamine, cadaverine, and ammonia do not produce any coloration. M. J. S.

Characteristic Reaction of Cane-sugar. By G. Popasogli (*Ann. Agron.*, 1898, **24**, 141; from *Bull. Assoc. Chim. Sucr. Dist.*, **13**, No. 1), —When 0·5 c.c. of a 5 per cent. solution of a cobalt salt and 5 c.c. of 50 per cent. soda solution are added to a 10 or 20 per cent. solution of saccharose, a stable amethyst coloration is produced. In the case of glucose, a blue colour is obtained, which soon becomes greenish. The two sugars are readily distinguished, and it is possible to recognise the presence of a tenth of saccharose in glucose, and to detect addition of cane-sugar to wine, condensed milk, &c. Honey gives a blue colour which changes to pale green; lactose gives an unstable blue. Substances to be examined should be freed from dextrin and gum by means of baryta and lead subacetate.

According to Beeson, a slight quantity of saccharose, in presence of much glucose, gives the blue coloration of glucose in reflected light, whilst in transmitted light, at a distance of about 80 cm. from the eye, the violet colour of saccharose can be seen (*Exp. Stat. Record*, **7**, 740). N. H. J. M.

Estimation of Starch in Cereals. By Carl J. Lintner (*Zeit. angw. Chem.*, 1898, 725—729).—This is an investigation as to the best methods of estimating starch in cereals. The final conclusions are: 1. The various methods in use all give different results, and an analyst should, therefore, state what process he has employed. 2. The substances which interfere are the pentosans. 3. When these are duly allowed for, the results obtained by various operators agree more closely. 4. The best process will be, no doubt, the method proposed by Sachsse:—dissolving and inverting the starch in one single operation, making due allowances for the dissolved pentosans.

L. DE K.

Detection of Sawdust in Meal. By G. A. LE ROY (*Compt. rend.*, 1898, **126**, 1047—1048).—When an alcoholic solution of phloroglucinol strongly acidified with phosphoric acid is added to meal and gently heated, any particles of sawdust that may be present acquire an intense carmine-red colour, whilst fragments of grain are but slightly affected and starch remains colourless. A hydrochloric acid solution of phloroglucinol acts too energetically, and the difference between the wood cellulose and the grain cellulose is not sufficiently distinct.

C. H. B.

Estimation of the Acidity of Urine. By CHARLES LEPIERRE (*Compt. rend.*, 1898, **126**, 1534—1536).—The author discusses the various methods that have been proposed for the estimation of the acidity of urine. He considers that the only exact method is that of Gautier, in which the liquid is made alkaline by means of standard sodium hydroxide solution, the phosphates and other salts precipitated by barium chloride, and the residual alkalinity determined in an aliquot part of the filtered liquid, using phenolphthalein as an indicator.

If this method is combined with the determination of the acidity by means of sodium hydroxide in presence of barium chloride and phenolphthalein without previous filtration, it is possible to determine the respective quantities of monometallic and bimetallic phosphates present.

C. H. B.

Estimation of Tartaric Acid in Presence of Citric Acid. By ARTHUR BORNTRÄGER (*Zeit. anal. Chem.*, 1898, **37**, 477—485).—To ascertain how far the process worked out by Warington and Grosjean (this Journ., 1875, 973; and Trans., 1879, 341) and investigated by the author (Abstr., 1886, 1082; 1887, 341), is suitable for the estimation of tartaric acid when citric acid is also present, mixtures containing 0·5 to 4 grams of hydrogen potassium tartrate with 0·5 to 5 grams of citric acid and 5 grams of potassium chloride were neutralised whilst hot by potash, cooled, made up to 50 c.c., and 6 c.c. of a 50 per cent. solution of citric acid added, stirred until a precipitate appeared, and left until the next day before filtering. The precipitates were washed with a 10 per cent. solution of potassium chloride saturated with hydrogen potassium tartrate, and finally twice with potassium chloride alone before titrating.

It was found that the mixture of 0·5 gram of tartrate and 5 grams of citric acid gave, under these conditions, no precipitate, but that a precipitate appeared when an additional gram of citric acid was added. In the cases where the citric acid originally present did not amount to more than twice as much as the tartrate, the use of 5 grams of citric acid as the precipitating agent gave fairly close quantitative results, but when the amounts of tartrate and (original) citric acid were about equal, 3 grams of citric acid sufficed for the precipitation.

The following rule is therefore laid down; such a quantity of the mixture is to be taken as corresponds in total acidity with 3 grams of citric acid. It is neutralised, &c., as above, and precipitated with 3 grams of citric acid. Should the amount of tartrate found be more than double that of the citric acid found, the operation must be repeated with the addition (to the original mixture) of enough citric acid to restore approximate equality. Should, on the other hand, the amount of tartrate found be less than half the citric acid found, equality must be restored by adding a weighed quantity of tartrate.

M. J. S.

Polarimetric Estimation of Gallotannic Acid. By R. F. Wood-Smith and Cecil Revis (*Analyst*, 1898, **23**, 33—35).—The process, which is intended for the estimation of gallotannic acid only, but which may, perhaps, be also extended to other kinds of tannin, is based on the fact that, under certain conditions, gelatin forms with tannin a precipitate of definite composition. Consequently, if a solution of gelatin be polarised before and after treatment with tannic acid, the difference in the two rotations will serve as an indication of the amount of tannin.

The details of the process are as follows: 25 c.c. of a 9 per cent. solution of *gold label gelatin* in water at 45° is put into a 100 c.c. evaporating dish and heated on the boiling water bath to 60°; 1 c.c. of soluble albumin is then added, and the whole heated for 10 minutes with constant stirring. After cooling to 50°, it is again heated to 100° and filtered; the precipitate is washed with boiling water and the filtrate made up to 50 c.c. at 45°. The liquid, which must be perfectly transparent, is now examined in a Schmidt and Haensch polarimeter at 45°.

Twenty-five c.c. of the same gelatin solution is now heated with tannin solution containing about 0·6 gram of gallotannic acid, and the liquid poured off into another dish, the precipitate being washed with boiling water. The turbid liquid is clarified as before with fresh white of egg, and then again polarised. Each degree difference in polarisation (sugar units) represents 0·0673 gram of tannin.

L. de K.

Detection of Cotton-seed Oil, Sesamé Oil, and Earth-nut Oil in Olive Oils. By Massimo Tortelli and R. Ruggeri (*Zeit. angw. Chem.*, 1898, 850—853).—The authors (this vol., ii, 465) have devised a process for the detection of cotton-seed oil in edible oils; and they now extend this method to the detection also of sesamé or earth-nut oil. To detect sesamé oil, 5—6 c.c. of the liquid fatty acids is shaken with an equal bulk of strong hydrochloric acid and 2 drops of a 1 per cent. alcoholic solution of furfuraldehyde. Even if only 1 per cent. of the adulterant is present, it gives a characteristic carmine-red colour to the acid.

To test for earth-nut oil, the insoluble lead soap is first thoroughly exhausted with ether, and then shaken with this solvent in the presence of dilute hydrochloric acid. The ether is distilled off, and the residue of fatty acids is dissolved in 100 c.c. of 90 per cent. alcohol containing a drop of dilute hydrochloric acid, and the whole is heated to 60°. After cooling to 10—20° for about 3 hours, the crystalline precipitate of lignoceric and arachidic acids is filtered off and washed, first three times with 10 c.c. of 90 per cent. alcohol, and then several times with alcohol of 70 per cent.; it is then dissolved off the filter by boiling absolute alcohol, and to the filtrate is added 100 c.c. of 90 per cent. alcohol and a drop of weak hydrochloric acid; after heating to 60°, the whole is allowed to cool for 3 hours. The crystals are washed as before, and, finally, redissolved in boiling absolute alcohol. After evaporating the solvent, and drying the fatty acids at 100°, the melting point is taken; if this is between 74° and 75·5°, it indicates the presence of earth-nut oil. The percentage divided by 0·048 represents the amount of the adulteration. L. DE K.

Oxidised Cotton-seed Oil, and a General Method for the Analysis of Oxidised Oils. By WILHELM FAHRION (*Zeit. angw. Chem.*, 1898, 781—785).—This is a study of the changes which take place in the constitution of cotton-seed oil when exposed to the air.

The experiments were made by saturating with cotton oil two pieces of wash-leather, previously exhausted with light petroleum, and then exposing them for 8 and 12 days respectively to the air. The first piece was exhausted with light petroleum, which was then evaporated; the second one was similarly treated, but yielded a further supply of fatty matter when again exhausted with ether. The three products thus obtained, on evaporation of the solvents, were then analysed, together with the original oil. The method employed was as follows. After taking the iodine, saponification, and acidity numbers as usual, 2 or 3 grams of the sample was saponified with 10 c.c. of 2N alcoholic soda, the alcohol evaporated, and the soap dissolved in hot water. It was then placed in a separating funnel, and decomposed with hydrochloric acid, 25 c.c. of light petroleum added, and, after thoroughly shaking, the whole was left over-night, when the clear aqueous liquid was drawn off, and the petroleum poured off from the undissolved sticky, oxidised fatty acids, the latter being slightly washed with more light petroleum. The residue left on evaporating the petroleum was weighed, dissolved in 25 c.c. of strong alcohol, titrated with N/2 soda, using phenolphthalein as indicator, and then shaken with light petroleum to dissolve the unsaponifiable matters. The oxidised acids are dissolved in hot alcohol, which is then evaporated in a weighed dish, allowance being made for any mineral matter which may be present. By deducting from the petroleum residue the weight of the unsaponifiable matter, the proportion of non-volatile acids is obtained, the molecular weight of which can be calculated from the amount of soda used. The weight of the total petroleum residue, *plus* that of the oxidised fatty acids, represents the Hehner number. It appears that, as the oxidation proceeds, the iodine figure gets very low, being 108·8 in the original sample, and only 55·4, 46·3, and 29·1 in the others; the Hehner figure also fell from 94·22 to 85·34, 83·62, and 74·20, and the non-volatile acids from 92·85 to 63·53, 62·91, and 35·76. The inner saponification figure fell from 186·9 to 128·8, 128·9, and 74·4. The amount of unsaponifiable matter fell from 1·1 to 0·72 in the last sample, but showed a slight apparent increase in the others. The molecular weight of the non-volatile acids fell from 278·1 to 276·2, 273·2, and 269·1. On the other hand, the acidity figure rose from 2·2 to 13·3, 13·8, and 33·4; the total saponification figure from 190·4 to 223·1, 227·5, and 271·3; and the oxidised fatty acids from 0·27 to 20·70, 19·43, and 37·72. The melting points of the non-volatile acids rose from 35—36° to 45—46°, 46°, and 51°.

When cotton-seed oil is oxidised by means of alkaline potassium permanganate, a large quantity of volatile acids, chiefly butyric, is obtained. L. DE K.

A New Method of Estimating Fat in Food, Flesh, Fæces, &c. By LEO LIEBERMANN and SALOMON SZÉKELY (*Pflüger's Archiv.*, 1898, **72**, 360—366).—The substance to be investigated is boiled with potassium hydroxide; alcohol is added, and then sulphuric acid carefully. After cooling, the mixture is extracted with light petroleum, the soap dissolved in the light petroleum is determined, and the fatty acids estimated by titration with decinormal alcoholic potash. Full details of quantities used and formulæ for calculating the fat are given. The method is rapid, can be used with various forms of food-stuff, and gives results which closely approximate to the amounts found by the older method of ether extraction W. D. H.

Fat Estimation by Liebermann's Saponification Method. By FERENCZ TANGL and J. WEISER (*Pflüger's Archiv.*, 1898, **72**, 367—369).—The method, the principle of which is given in the preceding abstract, was compared with Dormeyer's gastric digestion method; flesh and fæces were examined. The numbers came out approximately the same; on the average, the new method gives slightly higher results. The main advantage of the new method is its rapidity. W. D. H.

Official Instructions for the Examination of Fats and Cheese (*Zeit. anal. Chem.*, 1898, *suppt.* 7—30).—These official instructions, published on April 1st, 1898, by the Imperial Chancellor, prescribe in minute detail the mode of sampling and of carrying out the following analytical operations. Estimation in butter, margarine, lard, and other fats and oils, of the amounts of water, casein, milk-sugar, total ash, chlorine, &c.; detection of boric and salicylic acids, formaldehyde, artificial colouring matters, sesame, cotton seed, and other vegetable oils (by the phytosterol reaction); determination of the melting and solidifying temperatures of the fats and fatty acids, of the refractive index with the Zeiss refractometer, of the acid number, Reichert, Meissl, Köttstorfer, Hehner, and Hübl values, the non-saponifiable constituents, &c. In the case of cheese, the estimations of water, fat, total and soluble nitrogenous constituents, free acids and mineral constituents, and the procedure for ascertaining the origin of the fats present are described. The method of using the refractometer is very fully described, but it does not admit of serviceable abstraction apart from the illustrations given. M. J. S.

Testing Colophony. By KARL DIETERICH (*Zeit. angw. Chem.*, 1898, 915—919).—The author considers a sample to be commercially pure if it conforms to the following tests. It should be transparent, and when boiled with water should only give the faintest reaction with ferric chloride. It should leave practically no ash, and be entirely soluble in alcohol, oil of turpentine, ethereal oils, acetone, ether, chloroform, methylic alcohol, amylic alcohol, ethylic acetate, benzene, and carbon bisulphide; partially soluble in petroleum, the portion insoluble in light petroleum of low boiling point not to exceed 7 per cent. The acidity figure should vary from 145 to 185; the sp. gr. from 1·045 to 1·085.

The acidity is determined by dissolving 1 gram of the powdered sample in 25 c.c. N/2 alcoholic potash, allowing it to act for 2 hours in the cold; the excess of alkali is then titrated with N/2 sulphuric acid; no water should be added. The sp. gr. is conveniently determined by means of weak brines of sp. gr. varying from 1·070 to 1·085.

L. de K.

Detection of Colophony in Dammar Resin. By Eduard Hirschsohn (*Zeit. anal. Chem.*, 1898, **37**, 456—457; from *Pharm. Zeit. Russ.*, **31**, 609).—The estimation of the acid number does not give trustworthy results in this case. Colophony is readily dissolved by aqueous ammonia (0·96), and is reprecipitated by acids; dammar resin yields a yellowish or reddish extract, which gives a feeble opalescence with acids. The resin is digested with the ammonia for half an hour, and the filtered extract acidified with acetic acid. Five per cent. of colophony can be detected.

M. J. S.

Detection of Colophony in Guaiacum Resin. By Eduard Hirschsohn (*Zeit. anal. Chem.*, 1898, **37**, 459; from *Pharm. Zeit. Russ.*, **34**, 513).—The method prescribed by the Russian Pharmacopœia consists in precipitating the resin by water from its alcoholic solution and shaking the precipitate with potash, when the guaiacum dissolves to a clear solution, whilst colophony gives a turbid solution and a precipitate of resin soap. The method may be applied directly to the original resin. The powdered substance is shaken with potash solution of about 15 per cent.; a stronger solution would precipitate the potassium salt of the guaiacum resin, whilst a weaker one fails to precipitate the colophony soaps. The presence of soda must be avoided. Another method is to shake the finely powdered resin with 4 or 5 parts of light petroleum, and mix the colourless filtrate with an equal volume of a 0·1 per cent. aqueous solution of cupric acetate. The presence of colophony is revealed by a blue or bluish-green colour. Should less than 10 per cent. be present, the petroleum solution would need concentrating.

M. J. S.

Detection of Pyramidone in Urine. By Adolf Jolles (*Zeit. anal. Chem.*, 1898, **37**, 441—442).—Dimethylamidophenyldimethylpyrazolone, or pyramidone, prepared by Filehne and Spiro, and recommended by them as a substitute for antipyrin (*Berlin. Klin. Wochenshr.*, 1896, No. 48), yields bluish-violet colours when oxidised by ferric chloride, nitric and nitrous acids, and the halogens. Most of these colours rapidly fade and disappear, but the blue colour obtained with alcoholic iodine solution passes, after some time, into red. Hydrogen peroxide gives a blue colour only on warming; acidified permanganate acts too energetically, producing only colourless compounds. Of these reactions, that with iodine is alone suitable for detecting pyramidone in urine. A 1 per cent. iodine solution floated on the urine (after 0·2 gram of pyrazolone had been taken twice a day) gave a sharp, violet-red ring, which, on standing, passed into reddish-brown.

M. J. S.

Detection of Quinine. By Egidio Pollacci (*Gazzetta*, 1898, **28**, i, 391—394).—The author detects quinine by the formation of thalleoquinine as follows. A centigram of the quinine compound is dissolved in 1 c.c. of water and 2 drops of sulphuric acid. A small piece of lead peroxide is then put in, and the liquid gradually heated to boiling; after adding 3—4 c.c. of water and allowing to stand, a layer of ammonium hydroxide is poured in, when an emerald green disc or ring is produced. W. J. P.

Detection of Atropine and Hyoscyamine in Urine. By S. Vreven (*Chem. Centr.*, 1898, i, 225; from *Pharm. Centr.-H.*, 1897, **38**, 867).—Three hundred c.c. of the urine, after standing for 8 days, is made alkaline with ammonia, and after shaking with chloroform, the emulsion is drawn off and mixed with a little alcohol, which will cause the chloroform to separate; this is then shaken with acidified water, and the aqueous liquid is again made alkaline with ammonia and agitated with chloroform. Finally, the chloroform extract is evaporated, and the residue, dissolved in a drop of acidified water, is treated on a microscopic slide with a minute drop of a solution of 10 grams of potassium iodide, and 5 grams of cadmium iodide, in 100 c.c. of water (Marmé's reagent), and stirred until the milky liquid has become clear again. Crystals soon begin to form which, under the microscope, show very characteristic forms for either of the alkaloids. L. de K.

Application of the Digitonine Test. By C. C. Keller (*Chem. Centr.*, 1898, i, 222; from *Ber. Deutsch. Pharm. Ges.*, **7**, 470—471).—Kiliani having stated that digitonine does not occur in digitalis leaves, the author has repeated these experiments, and has come to the conclusion that Kiliani's digitaline was in reality digitonine.

If 0·01 gram of this alkaloid, dissolved in 5 c.c. of hydrochloric acid of sp. gr. = 1·19, is heated on the water bath, the liquid turns first yellow, then deep red, and finally dark blue. If, when cold, 20 c.c. of water is added, a blue liquid with a red fluorescence is obtained which soon diminishes. Of the other digitalis akaloids, digitaline alone gives a somewhat similar reaction. L. de K.

Cubebs. By C. Hartwich (*Arch. Pharm.*, 1898, **236**, 172—199).—The author considers in detail the morphological characteristics of cubebs, and of fruits which are employed for their adulteration. It is pointed out that amongst the latter are fruits which contain no cubebin, and yet cannot be distinguished, either in appearance or microscopically, from true cubebs; as, however, they fail to yield a red coloration with sulphuric acid, owing to the absence of cubebin, an easy means is afforded for their detection. W. A. D.

Detection of Albumoses in Urine. By Ivar Bang (*Zeit. anal. Chem.*, 1898, **37**, 410—411); from *Deut. med. Woch.*, 1898, **17**).—To avoid the disturbing effect of urobilin in testing for peptones with phosphomolybdic acid, 10 c.c. of the urine, to which, in a test tube, 8 grams of finely powdered ammonium sulphate is added, is heated for a moment to boiling; the peptone adheres to the walls of the tube, and its separation is best promoted by centrifugalising for ½—1 minute. The upper liquid is decanted, the sediment washed with alcohol, which also is poured off and can be tested for urobilin, and the residue is dissolved in a little water, and, after filtration, tested for the biuret reaction. Other colouring matters in urine are without influence. Should the alcoholic extract be red and show the spectrum of hæmatoporphyrin, the urine may be first precipitated by barium chloride in order to remove that substance. M. J. S.

Estimation of Proteids. By N. C. Henrik Schjerning (*Zeit. anal. Chem.*, 1898, 37, 413—422).—This communication is mainly a summing up of the author's earlier papers on the same subject (Abstr., 1894, ii, 371; 1895, ii, 428; 1896, ii, 631; this vol., ii, 271, 416). The reagents used are those described in Abstr., 1896, ii, 631, with the addition of a 5 per cent. mercuric chloride solution, which is used instead of lead acetate when that reagent does not give satisfactory results. In all cases, the proteid solution should be so far diluted that 10 c.c. of it contains nitrogen corresponding with 5 c.c. of N/10 acid. If a quantity of the solution sufficient to require 10 c.c. of N/10 acid fails to precipitate all the iron from 0·8 gram of ferric acetate (Abstr., 1896, ii, 631), the substance is regarded as poor in ash, and calcium chloride or sodium phosphate is added prior to the precipitation with tin, lead, and iron respectively. In all cases, the precipitation takes place in an acid solution. The criterion of a satisfactory precipitation is that a clear filtrate containing (except in the case of ferric acetate) an excess of the reagent is obtained. After collecting the precipitates on an 11 cm. extracted filter, it suffices to fill the filter twice with the appropriate washing liquid; the iron precipitate alone requires 3—4 washings. The analytical numbers are finally worked out as follows: the stannous chloride precipitate (a) contains albumin I; the lead acetate or mercuric chloride precipitate (b) contains albumins I and II, and denuclein; the ferric acetate precipitate (c) contains the above with propeptones; the uranium acetate precipitate (d) contains peptone in addition to the others; and the magnesium sulphate precipitate (e) contains the two albumins and the propeptones. Thence a = albumin I; $b-[a+(c-e)]$ = albumin II; $c-e$ = denuclein; $c-b$ = propeptones; $d-c$ = peptones. M. J. S.

Estimation of Gelatin. By P. Carles (*Chem. Centr.*, 1898, i, 226; from *Rev. Intern. Falsif.*, 10, 203).—Jean has published a process for the estimation of gelatin in meat extracts based upon its precipitation by tannin and the estimation of the excess of the latter by titration with iodine.

The author points out that various kinds of gelatin combine with various quantities of tannin; for instance, 1 gram of tannin precipitates 1 gram of isinglass, 0·91 gram of gelatin, 0·87 gram of so-called Bordeaux-gelatin, and 0·80 gram of glue; also 31 grams of white of egg, 25 grams of blood-serum, and 3·10 grams of commercial albumin. L. de K.

Estimation of Indican in Urine. By AMANN (*Chem. Centr.*, 1898, i, 152; from *Rép. Pharm.*, 1897, 437).—Twenty c.c. of urine is gently shaken with a few drops of sulphuric acid, 5 c.c. of chloroform and 5 c.c. of a 10 per cent. solution of sodium persulphate; the indigo thus generated dissolves in the chloroform, colouring it a more or less deep blue. This reaction is more delicate than the oxidation by means of a hypochlorite, hypobromite, or permanganate, and is not interfered with by the presence of albumin. Scatole gives a reddish-violet coloration with the reagent, but the colouring matter does not pass into solution in the chloroform; the intensity of the colour corresponds with the amount of scatole. L. DE K.

Estimation of Urinary Indican. By EYVIN WANG (*Zeit. physiol. Chem.*, 1898, **25**, 406—410).—The following method is recommended. The urine is precipitated with 20 per cent. solution of lead acetate, and the clear filtrate decomposed with the same volume of Obermayer's reagent. The mixture is then extracted with chloroform until the extract is colourless; the chloroform is evaporated, the residue dried on the water bath, and a few c.c. of concentrated sulphuric acid added; after 24 hours, 100 c.c. of water is added, and the liquid titrated with potassium permanganate. Various precautions to be adopted during the analysis are described fully. The author's results are reserved for a future paper. W. D. H.

Estimation of Indigotin on the Fibre. By A. BINZ and F. RUNG (*Zeit. angw. Chem.*, 1898, 904—905).—The authors think the following process is the best of all the methods as yet proposed. Ten grams of the cotton is boiled for 3 or 4 hours with 150 c.c. of glacial acetic acid in a Soxhlet's apparatus, and the acid is poured into 300 c.c. of water mixed with 150 c.c. of ether; the indigotin is completely precipitated, but remains suspended in the ethereal layer. The aqueous layer being removed by means of a separating funnel, the indigotin is collected on a weighed filter, washed with alcohol and ether, dried, and weighed.

Cellulose is also slightly dissolved by the acid, but the acetylised product remains dissolved in the ether. L. DE K.

Chemistry of Tobacco. By RICHARD KISSLING (*Chem. Zeit.*, 1898, **22**, 1—4).—*Estimation of the Moisture.*—The moisture is best determined by first partially drying the sample over sulphuric acid; when dry enough to be powdered, it is weighed, and then reduced to a fine powder; 1 gram of this is then dried over sulphuric acid for 24 hours, when it will generally be quite dry. The dried tobacco is very hygroscopic, and, after 24 hours, will have reabsorbed nearly all its original moisture.

Estimation of Malic and Citric Acids.—The following method is proposed. Ten grams of the powder containing about 4 per cent. of moisture is put into a porcelain basin and thoroughly impregnated with 10 grams of dilute sulphuric acid; the mass is now mixed with about 10 grams of powdered pumice so as to obtain a reasonably dry mixture, which is placed in a filter paper cartridge and extracted for 20 hours with ether to dissolve the organic acids. The ether is then diluted to 100 c.c., and extracted by being shaken with 100 c.c. of water saturated with ether, the extraction being repeated two or three times; the mixed aqueous solutions are diluted to 250 c.c., and 25 c.c. of this is warmed to expel the ether, and then titrated with standard baryta water; in this way, the joint amount of citric and malic acids is obtained. To find the amount of malic acid, the neutralised liquid is cooled to 0°, which causes the barium citrate to crystallise out; the precipitate is then washed with 20 c.c. of cold water, afterwards with 50 c.c. of a mixture of equal vols. of alcohol and ether, and the barium malate is completely precipitated by adding to the filtrate 160 c.c. of the same ether-alcohol mixture. The precipitate after being washed with a little ether-alcohol is dried and ignited, and from the amount of ash (barium carbonate) the amount of malic acid is calculated. The barium citrate precipitate is treated in the same manner. L. DE K.

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  $C_{22}H_{20}O_8$, obtained from β-phenylglutaric anhydride, and its silver salt (Avery and Bouton), A., i, 527.
  $C_{24}H_{40}O_2$, from reduction of cholic acid; its anhydride, and nitro-derivative (Pregl), A., i, 709.
  $C_{108}H_{140}N_{28}O_{43}S$, formed by action of nitrous acid on albumose; its barium salt (Schrötter), A., i, 610.
Acid, obtained from beetroot juice; calcium salt (von Lippmann), A., i, 377.
  isomeric with 1-phenylbenzene-2:3:5:6-tetracarboxylic acid, and its salts (Michael and Bucher), A., i, 256.
  (m. p. 135°) and acid decomposing at 220—260° from *Ramalina ceruchis* (Hesse), A., i, 532.
  (m. p. 142°) occurring in *Roccella decipiens* (Hesse), A., i, 533.
  obtained from wool wax, and its magnesium salt (Darmstaedter and Lifschütz), A., i, 245.
  standard, preparation of, by absorption of hydrogen chloride (Moody), T., 658; P., **1898**, 149.
Acidimetry, use of the electrometer for titration (Böttger), A., ii, 89.
  use of normal sodium oxalate in (Sörensen), A., ii, 185.
Acidity, estimation of, in beer, &c. (Ott), A., ii, 464.
  precipitation of caseinogen in milk as test of (Grützner), A., i, 100.
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  secretion of, by molluscs (Schoenlein), A., ii, 442.
  action of, as poisons (Winterberg). A., ii, 530.
Acids, amido-, isolation of (Orloff), A., i, 295.
Acids, dibasic, formation of anhydrides of (Étaix), A., i, 125.
Acids, fatty, from fusion of camphoric acid with potash (Crossley and Perkin), T., 4; P., **1897**, 217.
Acids, organic, absorption spectra of (Spring), A., ii, 201.
    action of silent electric discharge on, in presence of nitrogen (Berthelot), A., i, 558.
    oxidation of, in presence of ferrous iron (Fenton), P., **1898**, 119.
Acids (or their salts or derivatives). See also:—
  Abietic acid.
  Acetaldehydedisulphonic acid.
  Acetalmalonic acid.
  Acetamidobenzoic acid.
  p-Acetamidosalicylic acid.
  Acethydroxamic acid.
  Acethydroxamic-carbonic acid.
  Acetic acid.
  Acetoacetic acid.
  Acetonedicarboxylic acid.
  Acetonedipyruvic acid.
  Acetonic acid.
  a-Acetonyltricarballylic acid.

Acids. See :—
Acetophenonecarboxylic acid.
Acetoxytetramethylglutaric acid.
Acetylbenzoylmesaconic acid.
α-Acetylbutanetetracarboxylic acid.
Acetyl*iso*butylsuccinic acid.
Acetylcamphoroxalic acid.
γ-Acetyldimethylacetoacetic acid.
Acetyldimethylbutyric acid.
Acetylenedicarboxylic acid.
Acetylethyltricarballylic acid.
Acetylgallotannic acid.
Acetylphenyldichloracetic acid.
Acetylphenyldimethyldihydropyridinecarboxylic acid.
Acetylpyruvic acid.
Acetylsuccinic acid.
Acetylsyringic acid.
Acetyltartaric acid.
α-Acetyltricarballylic acid.
Acetyluracilcarboxylic acid.
Aconitic acid.
Acrylic acid.
Adipamic acid.
Adipic acid.
Aldehydopyromucic acid.
Allylphosphoric acid.
Amylenepentacarboxylic acid.
iso-Amylidenedimalonic acid.
1-*iso*-Amylindolecarboxylic acid.
Anhydrobisdiketohydrindenecarboxylic acid.
Anhydrocamphoronic acid.
Anhydrofenchocarboxylic acid.
Anilinoacetic acid.
Anilino-β-*iso*butyric acid.
Anilinomalonanilic acid.
Anilinomalonic acid.
Anilino-α-phenylacetic acid.
Anilino-α-propionic acid.
Anilpyruvic acid.
Anisenyltetrazotic acid.
Anisic acid.
Anisoylacetic acid.
Anisoylacetoacetic acid.
Anisoylglyoxylic acid.
Apocrenic acid.
Aspartic acid.
Atranoric acid.
Atranorinic acid (*physciol*).
Atraric acid.
Atronic and *iso*-Atronic acids.
Atropic and *iso*-Atropic acids.
Azelaic acid.
Azelamic acid.
Azoxybenzoic acid.
Barbatic acid.
Behenic acid.
Benzaldehyde-*o*-sulphonic acid.
o-Benzamidocinnamic acid.
α-Benzamidohydroxycinnamic acid.
Benzaminesulphonic acid.

Acids. See :—
Benzanilidosulphonic acid.
Benzeneazobenzoic acid.
Benzenediazocarbamide-benzenesulphinic acid.
Benzenediazoic acid.
Benzenesulphinic acid.
Benzenesulphonic acid.
Benzenetetradi-*m*-phosphoric acid.
Benzenylaminofumaric-esoanhydridecarboxylic acid.
Benzenyloxytetrazotic acid.
Benzenyl*di*oxytetrazotic acid.
Benzenyltetrazotic acid.
Benzhydroxamic acid.
Benzilideneacetoacetic acid.
Benzoic acid.
Benzophenonesulphonic acid.
Benzotoluido-*o*-sulphonic acids.
Benzoylacetohydroxamic acid.
Benzoylacetic acid.
Benzoylbenzhydroxamic acid.
Benzoylglutaric acid.
ω-Benzoylheptoic acid.
Benzoyl*iso*nicotinic acid.
β-Benzoylpropionic acid.
Benzoylpyruvic acid.
Benzoyl*iso*succinic acid.
Benzoyltartaric acid.
α-Benzoyltricarballylic acid.
Benzylaminobutyric acid.
Benzylaminocinnamic acid.
Benzylaminopropionic acid.
Benzylamino-*iso*-valeric acid.
Benzylic acid.
Benzylideneacetonoxalic acid.
Benzylideneaminosalicylic acid.
Benzylidenediacetoacetic acid.
Benzylidenediacetonedicarboxylic acid.
Benzylidenedimalonic acid.
Benzylideneglutaric acid.
Benzylidenemalonic acid.
Benzylidene-β-naphthylaminoacetoacetic acid.
Benzylidenetropinic acid.
Benzyliminophenylpropionic acid.
5-Benzylindole-α-carboxylic acid.
Benzylmalonic acid.
Benzylmethylmalonic acid.
Benzyloxalacetic acid.
Benzylphenacylacetic acid.
Benzylphosphinic acid.
Benzylpyruvic acid.
Benzylsulphonic acid.
Betorcinolcarboxylic acid.
Bilianic acid.
iso-Butanedicarboxylic acid.
cyclo-Butanedicarboxylic acids.
Butanepentacarboxylic acid.
Butoxysuccinic acid.
iso-Butylacetic acid.

Acids. See :—
Butylenepentacarboxylic acid.
iso-Butylethanetricarboxylic acid.
1′-*iso*-Butylindolecarboxylic acid.
iso-Butyllevulinic acid.
Butylphthalidecarboxylic acid.
iso-Butylsuccinic acid.
1 : 3 : 5-Butyltoluic acid.
Butylxylylcarboxylic acid.
Butylxylylglyoxylic acid.
Butyric and *iso*-Butyric acids.
Caffeic acid.
Caffeidinecarboxylic acid.
Callopismic acid.
Camphorcarboxylic acid.
Camphopyric acid.
Camphoranic acid.
Camphoric acid.
Camphoronic and *iso*Camphoronic acids.
Camphoroxalic acid.
Camphorsulphonic acid.
Camphylic acid.
Cannabinic acid.
Cantharic acid.
Cantharidin.
Caperatic acid.
Capranic acid.
Caprarie acid.
Caproic acid.
Carbamidohydrazidoacetic acid.
Carbanilphenylaminoacetic acid.
Carbocinchomeronic acid.
Carboxybenzoylformic acid.
2-Carboxy-3 : 4-dimethoxymandelic acid.
Carboxyglutaric acid.
Carboxymethylquinolineacetic acids.
Carboxyphenyl*di*chloracetic acid.
Carminic acid.
Carnaubaic acid.
Carnic acid.
Cerotic acid.
Cetraric acid.
Cholanic acid.
Cholesteric acid.
Cholic acid.
Cholylic acid.
Chrysocetraric acid.
Chrysophanic acid.
Cinchotinesulphonic acid.
Cinnamic acid.
Cinnamylideneacetoacetic acid.
Citraconic acid.
Citric acid.
Coccellic acid.
Corydalinic acid.
p-Coumaric acid.
Crotonic acid.
β-*iso*-Cuminic acid.
Cumylideneacetoacetic acid.
Cyanuric acid.

Acids. See :—
Cymenesulphonic acid.
Deamidoalbuminic acid.
Dehydracetic acid.
Dehydroanisoylacetic acid.
Dehydrocholic acid.
Deoxybenzoin-*β*-carboxylic acid.
Diacetylglyceric acid.
Diacetylphenyldimethylpyridinecarboxylic acid.
Diacetylsuccinic acid.
Diacetyltartaric acid.
Diallylphosphoric acid.
Dianhydrobisdiketohydrindenecarboxylic acid.
Dianilinobenzylideneacetonedicarboxylic acid.
Diazobenzenebromobenzenesulphinic acid.
Diazobenzenetoluenesulphinic acid.
Diazocarboxylic acid.
p-Diazo-*o*-toluenesulphonic acid.
Dibenzhydroxamic acid.
Dibenzoylhydrazido-acetic acid.
Dibenzyl-*α*-carboxylic acid.
Dibenzyldisulphonic acid.
Dibenzyl 2 : 2′-disulphonic acid.
Di-*iso*-butylacetic acid.
Di-*iso*-butylglycollic acid.
Di-*iso*-butylmalonic acid.
Dicarboxyglutaconic acid.
Didecylsuccinic acid.
β-Diethoxyacrylic acid.
Diethoxymethyleneacetonedicarboxylic acid.
Diethoxyphenylpropionic acid.
Diethoxypropionic acid.
Diethoxypyrotartaric acid.
Diethylacetoacetic acid.
Diethylaminobenzoylbenzoic acid.
Diethylaminobenzylbenzoic acid.
Diethylamino-*m*-hydroxy-*o*-benzoylbenzoic acid.
Diethylamino-*m*-hydroxylbenzylbenzoic acid.
Diethylguaiaretic acid.
Diethylmalonic acid.
Diethylparabanic acid.
Diethylphosphoric acid.
Diethylthioparabanic acid.
Diglycerophosphoric acid.
Dihydrocamphoric acid.
Dihydrocamphoronesulphonic acid.
Dihydro-*β*-camphylic acid.
Dihydro-*iso*-indolebenzoic acid.
Dihydro-*iso*-lauronic acid.
Dihydro-*iso*-lauronolic acid.
Dihydronaphthoic acid.
Dihydrophthalic acid.
Dihydropiperylenedicarboxylic acid.
Dihydroxydicarboxyphenylacetic acid.
Dihydroxybenzoic acid.

Acids. See :—
Dihydroxydihydro*cyclo*geranic acid.
Dihydroxydihydro*iso*geranic acid.
Dihydroxymaleic acid.
1 : 3-Dihydroxynaphthalene-2-carboxylic acid.
Dihydroxynicotinic acid.
Dihydroxyphenylacetic acid.
Dihydroxypyridinecarboxylic acids.
Dihydroxypyridinedicarboxylic acid.
Dihydroxystearic acid.
Dihydroxytartaric acid.
Diketohydrindenedicarboxylic acid.
Diketo-octohydrophenanthrenecarboxylic acid.
Dimethoxybenzoic acid.
Dimethoxydiphenyltetrahydropyronedicarboxylic acid.
Dimethylacetoacetic acid.
Dimethyladipic acid.
Dimethylamino-*o*-benzoylbenzoic acid.
Dimethylaminobenzylbenzoic acid.
Dimethylanilinohydrophthaloylic acid.
Dimethylanilinophthaloylic acid.
Dimethylaspartic acid.
Dimethylbutylmandelic acid.
Dimethylcinchonic acids.
Dimethyleneprotocatechuic acid.
Dimethylfumaric acid.
ββ-Dimethylglutamic acid.
Dimethylglutaric acids.
Dimethylitaconic acid.
Dimethyllevulinic acid.
Dimethylmalonic acid.
Dimethylphosphoric acid.
2 : 4-Dimethylpyridine-3-carboxylic acid.
1 : 2′-Dimethylquinoline-4′-carboxylic acid.
3 : 2′-Dimethylquinoline-3′-4′-dicarboxylic acid.
Dimethylsuccinic acids.
Dimethyltricarballylic acid.
Dimethyluric acids.
Diphenacylfumaric acid.
Diphenoxythiophosphoric acid.
2′-3′-Diphenylcinchonic acid.
Diphenylphosphoric acid.
Diphenyltetrahydropyronedicarboxylic acid.
Diphenylthioparabanic acid.
1 : 5-Diphenyl 1 : 2 : 3-triazole-4-carboxylic acid.
Dipropylmalonic acid.
Dipulvic acid.
Dipyridyltetracarboxylic acid.
Di-*p*-tolylthioparabanic acid.
Divaricatic acid.
Divaricatinic acid.
Divarictic acid.
Eicosylmalonic acid.

Acids. See :—
Elaidic acid.
Ellagitannic acid.
Erucic acid.
Erythric acid.
Ethane-αβ-disulphinic acid.
Ethane-αβ-disulphonic acid.
Ethanetetracarboxylic acid.
Ethane-$\alpha\alpha\alpha_1$-tricarboxylic acid.
Ethoxyacrylic acid.
Ethoxybehenic acid.
Ethoxybenzenesulphonic acid.
γ-Ethoxybutyric acid.
β-Ethoxycinnamic acid.
Ethoxycitraconic acid.
Ethoxydiphenylphthalamic acid.
p-Ethoxyglauconic acid.
p-Ethoxyhydroglauconic acid.
Ethoxymalonic acid.
Ethoxymethyleneacetonedicarboxylic acid.
Ethoxymethylenemalonic acid.
p-Ethoxyphenyloxamic acid.
Ethoxypropionic acids.
Ethoxysuccinic acid.
δ-Ethoxyvaleric acid.
Ethylacetoacetic acid.
Ethylallylparabanic acid.
Ethylallylsuccinic acid.
Ethylallylthioparabanic acid.
Ethylaminobenzoic acid.
Ethylanilino-α-butyric acid.
Ethylanilino-α-propionic acid.
Ethylenebenzhydrylcarboxylic acid.
Ethylenesulphonic acid.
α-Ethylglutaric acid.
Ethylideneacetoacetic acid.
α-Ethylideneglutaric acid.
Ethylmalonic acid.
Ethylnitrolic carbonic acid.
Ethylparabanic acid.
Ethylphosphoric acid.
α-Ethylpropane-$\alpha\alpha^1$-β-tetracarboxylic acid.
Ethylpulvic acid.
Ethylsuccinic acid.
Ethylthioparabanic acid.
Evernic acid.
Everninic acid.
Fenchenephosphonic acid.
Fenchocarboxylic acid.
Fencholenic acid.
Filicic acids.
Filicinic acid.
Flavaspidic acid.
Formaldehydetrihydroxyfluoronedicarboxylic acid.
Formamidinediazoamidoformic acid.
Formaurindicarboxylic acid.
Formazylbenzenecarboxylic acid.
Formazylbenzenedicarboxylic acid.
Formhydroxamic acid.

Acids. See :—
Formic acid.
Fumaramic acid.
Fumaric acid.
Furfuracrylideneacetic acid.
Furfuracrylidenemalonic acid.
Furfuracrylidenephenylacetic acid.
Furfuracrylidenepyruvic acid.
Furfurylidenephenylacetic acid.
Furfurylidenepyruvic acid.
Furfurylsuccinic acid.
Gallic acid.
Gallotannic acid.
Geronic and *iso*-Geronic acids.
Glauconic acid.
Gluconic acid.
Glutaconic acid.
Glutamic acid.
Glutaric acid.
Glyceric acid.
Glycerophosphoric acid.
Glycocholic acid.
Glycollic acid.
Glyoxylic acid.
Guaiaretic acid.
Gyrophoric acid.
Hæmatommic acid.
Hæmatomminic acid.
Harminic acid.
Hemimellithenetricarboxylic acid.
Hemipinic acids.
cyclo-Heptanecarboxylic acid.
cyclo-Heptatrienecarboxylic acid.
iso-Heptenoic acid.
Heptoic acid.
Heptylmalonic acid.
Hexahydrocumic acid.
Hexahydroterephthalic acid.
cyclo-Hexanedicarboxylic acids.
cyclo-Hexenedicarboxylic acids.
$\gamma\delta$-Hexenoic acid.
cyclo-Hexinenedicarboxylic acids.
Homoitaconic acid.
Homophthalic acid.
Hydrazidoacetic acid.
Hydrazido-*p*-phenoxyacetic acid.
Hydrocinchoninesulphonic acid.
Hydrocyanic acid.
Hydrodiphthalolactonic acid.
Hydroglauconic acid.
Hydromuconic acid.
Hydro-β-naphthaglauconic acid.
Hydrotheobromuric acid.
o-Hydroxyanilinobutyric acid.
p-Hydroxyanilinopropionic acid.
Hydroxybehenic acid.
Hydroxybenzoic acids.
Hydroxybenzylideneaminoformic acid.
o-Hydroxybenzylidenehydrazidoacetic acid.
Hydroxybenzylsulphonic acid.
γ-Hydroxy-α-*iso*-butylvaleric acid.

Acids. See :—
Hydroxybutyric and α-Hydroxy-*iso*-butyric acids.
Hydroxycarbaminic acid.
Hydroxydiazobenzylsulphonic acid.
α-Hydroxydi*iso*butylacetic acid.
5-Hydroxy-2-dimethoxymethylphenylhydro-4-pyrone-6-carboxylic acid.
1-Hydroxy-2 : 6-dimethylpiperidone-6-carboxylic acid.
Hydroxydiphenylphthalamic acids.
Hydroxydiphenylpropionic acid.
Hydroxyfenchenic acid.
ω-Hydroxyhexahydrotoluic acid.
Hydroxyhexoic acid.
Hydroxyketopimelic acid.
2′-Hydroxylepidinic acid.
Hydroxymethylbenzenesulphonic acid.
α_1-Hydroxy-α_1-methyl-α-*iso*butylglutaric acid.
1-Hydroxymethyl*cyclo*hexane-2-carboxylic acid.
Hydroxymethyl*iso*propylacetic acid.
Hydroxynonoic acid.
α-Hydroxypentenoic acid.
Hydroxyphenylbutyric acid.
Hydroxyphenylcinnamic acid.
α-Hydroxy-γ-phenylcrotonic acid.
p-Hydroxyphenyloxamic acid.
Hydroxypropanesulphonic acid.
Hydroxypyridinedicarboxylic acid.
Hydroxysalicylic acid.
Hydroxyterephthalic acid.
β-Hydroxytetramethylglutaric acid.
Hydroxytolueneazobenzoic acid.
Hydroxytoluic acid.
Hydroxytrimesic acid.
α-Hydroxyvaleric acid.
Indoneacetoacetic acid.
Indonemalonic acid.
Indoxylic acid.
Iodosponginsulphonic acid.
Iononeoximeacetic acid.
Itaconic acid.
Isatic acid.
Jalapinolic acid.
Ketophenylhomoparaconic acid.
Ketophenylparaconic acid.
Lactic acid.
Lauric acid.
iso-Lauronic acid.
Lauronolic and *iso*-Lauronolic acids.
Lecanoric acid.
Lepidinic acid.
Leucic acids.
Leucine.
Levulinic acid.
Lichenostearic acid.
Lupulinic acid.
Lutidinecarboxylic acid.
ψ-Lutidostyrilcarboxylic acid.
Lysuric acid.

Acids. See :—
Maleamic acid.
Maleic acid.
Malephenylamic acid.
Malic acid.
Malonic acid.
Mandelic acid.
Mannosaccharic acid.
Meconic acid.
Melanoidic acid.
Mellitic acid.
Menthonecarboxylic acid.
Menthonedicarboxylic acid.
Mesaconic acid.
Mesitylcarboxylic acid.
Mesitylenic acid.
Mesotartaric acid (under tartaric acid).
Methanedisulphonic acid.
Methenylbisacetonedicarboxylic acid.
Methoxybenzenesulphonic acid.
Methoxybenzoic acid.
Methoxydiphenylphthalamic acid.
Methoxynaphthoic acid.
Methoxynaphthylglyoxylic acid.
o-Methoxyphenylcarbamic acid.
p-Methoxyphenyloxamic acid.
Methoxyphenylpyruvic acid.
i- and *l*-Methoxypropionic acid.
p-Methoxy-*o*-sulphobenzoic acid.
Methylacetoacetic acid.
p-Methylacetophenone-α-phthalamic acid.
Methylallylparabanic acid.
Methylallylthioparabanic acid.
u-Methyl-*m*-amino-*p*-phenoxyacetic acid.
Methylanilinobutyric acid.
Methylanilinophenylacetic acid.
Methylanilinopropionic acid.
Methylaspartic acid.
Methyl*iso*barbituric acid.
Methyl*iso*butylketosulphonic acid.
Methyl*iso*butylketoximesulphonic acid.
2′-Methylcinchonic acid.
Methylcyanuric acid.
Methyl*iso*dialuric acid.
Methylenedicresotic acid.
Methylenedigallic acid.
Methylenemalonic acid.
Methylethylitaconic acid.
Methylethylmalonic acid.
Methylethylpyridinedicarboxylic acid.
4-Methyl-3′-ethylquinolinesulphonic acid.
Methylethylsuccinic acid.
Methylethylthioparabanic acid.
Methylfurazancarboxylic acid.
Methylglyoximecarboxylic acid.
Methylguanidoacetic acid.
p-Methylisatic acid.
Methylitaconic acid.

Acids. See :—
β-Methyllevulinic acid.
Methylmalonic acid.
p-Methyloctylbenzenesulphonic acid.
o-Methylolhexahydrobenzoic acid.
μ-Methyloxazole-α-carboxylic acid.
Methylparabanic acid.
Methylphosphinic acid.
Methylphosphoric acid.
Methylpropanetetracarboxylic acids.
Methyl*iso*propylacetic acid.
Methylpyrazolone-*p*-phenoxyacetic acid.
Methylquinolinecarboxylic acids.
Methylsalicylic acid.
Methylsuccinic acid.
Methyltetrahydropyridinecarboxylic acid.
Methyluracilcarboxylic acid.
β-Methyluramidacrylic acid.
Methyluric and Methyl-ψ-uric acid.
Mucic acid.
Myristic acid.
Myronic acid.
β-Naphthaglauconic acid.
Naphthalenesulphonic acid.
Naphthalenethiosulphonic acid.
α-Naphthaquinoline-3′-sulphonic acid.
β-Naphthenyldioxytetrazotic acid.
β-Naphthilpyruvic acid.
β-Naphthylaminomalonic acid.
β-Naphthylindoxylic acid.
Nonoic acid.
Nor-rangiformic acid.
Octoaspartic acid.
Octoic acid.
Octylmalonic acid.
Œnanthylideneacetoacetic acid.
Oleic acid.
Opianic acid.
Orylic acid.
Ouabic acid.
Oxalacetic acid.
Oxalic acid.
Oxalobutyric and Oxalo*iso*butyric acids.
Oxalolevulinic acid.
Oxalopropionic acid.
Oxamic acid.
Oxanilic acid.
Oximidopropionic acid.
Oxycarnic acid.
Oxyproteic acid.
Oxyprotosulphonic acid.
Oxypulvic acid.
Oxyroccellic acid.
Oxytetramethyluric acid.
Palmitic acid.
Papaveric acid.
Pentanedicarboxylic acid.
cyclo-Pentanedicarboxylic acids.

Acids. See :—
cyclo-Pentane-1:1:3:3-tetracarboxylic acid.
Δ^1-*cyclo*-Pentenecarboxylic acid.
Phenacylethylacetic acid.
Phenacylmethylacetic acid.
Phenacylpropylacetic acid.
Phenethenyloxytetrazotic acid.
Phenolphthaloylic acid.
p-Phenolsulphonic acid.
Phenoxyacetic acid.
p-Phenoxybenzylideneacetic acid.
δ-Phenoxy-α-ethylvaleric acid.
γ-Phenoxypropylethylmalonic acid.
Phenoxythiophosphamic acid.
Phenoxythiophosphoric acid.
Phenylacetic and ψ-phenylacetic acids.
Phenylazo-β-hydroxylaminopropionic acid.
1-Phenylbenzene-2:3:5:6-tetracarboxylic acid.
3′-Phenyl-2′-benzylquinoline-4′-carboxylic acid.
1-Phenyl-4-benzyl-5-pyrazolone-3-carboxylic acid.
Phenylcarbamacetic acid.
Phenylcarbinolacetoacetic acid.
2′-Phenylcinchonic acid.
Phenylcinnamic acid.
βγ-Phenyl*iso*crotonic acid.
Phenyldiethylhydroresorcylic acid.
Phenyldimethylhydroresorcylic acid.
Phenyldimethyloxypyrrodiazolecarboxylic acid.
Phenylditolylmethanecarboxylic acid.
Phenylenediamineazophenyloxamic acid.
p-Phenylenedisulphonamic acid.
Phenylethylparabanic acid.
Phenylethylthioparabanic acid.
β-Phenylglutaranilic acid.
β-Phenylglutaric acid.
β-Phenylglutaro-*p*-tolilic acid.
Phenylglycine-*o*-carboxylic acid.
Phenylglycolenyloxytetrazotic acid.
Phenylglycolenyl*di*oxytetrazotic acid.
Phenylglyoxenyl*di*oxytetrazotic acid.
Phenylmethylitaconic acid.
Phenylmethylketotetrahydropyridazinecarboxylic acid.
Phenylmethylparabanic acid.
4-Phenyl-2-methyltetrahydropyridone-3:5-dicarboxylic acid.
Phenylmethylthioparabanic acid.
1-Phenylnaphthalene-2:3-dicarboxylic acid.
Phenylpentenoic acid.
Phenylpropanetricarboxylic acid.
Phenylpropiolic acid.
Phenylpropionic acid.
Phenylpropylenetricarboxylic acid.

Acids. See :—
1-Phenylpyrazole-3:4-dicarboxylic acid.
1-Phenylpyrazolepropionic acid.
Phenylpyrrodiazolonecarboxylic acids.
2′-Phenylquinoline-3′-4′-dicarboxylic acid.
Phenylsaffranolcarboxylic acid.
Phenylsaffranolsulphonic acid.
Phenylsulphonamic acid.
p-Phenylsulphonebenzoic acid.
Phenyltetrahydronaphthalenedicarboxylic acid.
Phenylthioaminohydantoic acid.
Phenylthioglycollic acid.
1-Phenyl-1:2:3-triazole-4:5-dicarboxylic acid.
Phenyluracilcarboxylic acid.
β-Phenyluramilacrylic acid.
Phenylvaleric acid.
δ-Phenyl-δ-valerolactone-γ-carboxylic acid.
Phthalaldehydic acid.
Phthalazine-1′-acrylic acid.
Phthalic acid.
Phthalidecarboxylic acid.
Phthalonic acid.
Phyllocyanic acid.
Physciacic acid.
Physodalic acid.
Physodic acid.
Phytosterol.
Pimelic acid.
β-Piperidocrotonic acid.
Piperidylcinnamic acid.
Piperidylpyrotartaric acid.
Piperidylsuccinic acid.
Piperidyltricarballylic acid.
Podophyllic acid.
cyclo-Propane-αα-dicarboxylic acid.
s-Propanehexacarboxylic acid.
Propane-1-al-3-oic acid.
s-Propanepentacarboxylic acid.
Propanetetracarboxylic acid.
Propionic acid.
Propionylformic acid.
Propoxypropionic acids.
Propoxysuccinic acid.
iso-Propyl*iso*butylacrylic acid.
α-*iso*-Propyl-β-*iso*butylhydracrylic acid.
Propylenetetracarboxylic acid.
1′-Propylindolecarboxylic and 1′-*iso*-Propylindolecarboxylic acids.
iso-Propylmalonic acid.
α-*iso*-Propylpropane-$\alpha\alpha\alpha_1$-β-tetracarboxylic acid.
Propylsuccinic and *iso*-Propylsuccinic acids.
Protocetraric acid.
Pulegenic acid.
Pulvic acid.

Acids. See :—
Pyridine-2 : 3 : 4-tricarboxylic acid.
4-Pyridone-3 : 5-dicarboxylic acid.
Pyrocinchonic acid.
Pyrogallol-dicarboxylic and -tricarboxylic acids.
Pyromucic acid.
Pyruvic acid.
2′ : 4′-Quinolinedicarboxylic acid.
Quinoltetracarboxylic acid.
Racemic acid.
Ramalic acid.
Rangiformic acid.
Rhamnohexonic acid.
Rhizocarpic acid.
Rhizonic acid.
Rhizoninic acid.
Ricinoleic and ψ-Ricinoleic acids.
Roccellaric acid.
Roccellic acid.
Saccharic acid.
Salazinic acid.
Salicylic acid.
Salicyluric acid.
Santonic acid.
Sarcomelaninic acid.
Sebacic acid.
Sebamic acid.
α- and β-Scymnolsulphuric acids.
Sinapic acid.
Sphærophoric acid.
Squamaric acid.
Stearic acid.
Stilbenedisulphonic acids.
Strychnic acid (*strychnol*).
iso-Strychnic acid (*dihydrostrychnine*).
Strycholcarboxylic acid.
Suberamic acid.
Suberic acid.
Succinic and *iso*-Succinic acids.
Succinophenylamic acid.
Sulphobenzeneazobenzoic acid.
Sulphobenzeneazo-2-hydroxynaphthaquinone.
Sulphocamphylic acid.
p-Sulphonaphthaleneazohydroxynaphthaquinone.
Syringic acid.
Tanacetogendicarboxylic acid.
Tannic acid.
Tartaric acids.
Tartronic acid.
Tetrahydrofurandibenzoic acid.
Tetrahydrophthalic acid.
Tetrahydro*iso*quinolinesulphonic acid.
Tetrahydroterephthalic acid.
Tetrahydroxyxanthenedicarboxylic acid.
Tetramethyldiaminobenzophenonesulphinic acid.
Tetramethylene-1 : 3-dicarboxylic acid.

Acids. See :—
Tetramethylglutaric acid.
Tetramethyl-*m*- phenylenediamineazobenzenesulphonic acid.
Tetramethyluric acid.
Tetraspartic acid.
Theobromuric acid.
Theuric acid.
Thiocyanic acid.
Thiosalicylic acid.
Tolenyldioxytetrazotic acid.
Tolenyloxytetrazotic acid.
Tolenyltetrazotic acid.
o- and *p*-Tolilpyruvic acids.
Tolueneazobenzoic acid.
Tolueneazosalicylic acid.
Toluenedisulphonic acid.
p-Toluenesulphinic acid.
Toluenesulphonic acids.
Toluenethiosulphonic acid.
Toluic acids.
Toluidinedisulphonic acid.
Toluidino-butyric and -*iso*butyric acids.
p-Toluidinomalonic acid.
Toluidinophenylacetic acids.
Toluidinopropionic acids.
Toluidino*iso*valeric acids.
p-Toluoyl-*o*-benzoic acid.
β-*p*-Toluoylpicolinic acid.
o-, *m*-, and *p*-Toluoyltartaric acids.
Tolylacetic acid.
p-Tolylindoxylic acid.
p-Tolylmethylphosphinic acid.
Tolyloxamic acid.
Tolylpyruvic acid.
Tolylsulphonamic acid.
Trianisylstibic acid.
1 : 2 : 3-Triazole-4 : 5-dicarboxylic acid.
Tricarballylic acid.
2 : 4 : 4′-Trihydroxy-2′-methylquinoline-3-carboxylic acid.
as- Trimesic acid.
Trimethylacetic acid.
Trimethylglutaric acids.
Trimethyl*cyclo*hexanonesulphonic acid.
tert-Trimethyl-β-phenyl-δ-ketohexoic acid.
1 : 3 : 2′-Trimethylquinoline-4′-carboxylic acid.
Triphenylacrylic acid.
Triphenylcarbinoltricarboxylic acid.
Tropinic acid.
Tropinoneoxalic acid.
Umbilicaric acid.
Uracilcarboxylic acid.
Uric acid.
Urocaninic acid.
Uroproteic acid.
Usnic acid.

Acids. See :—
  Valeric and *iso*-Valeric acids.
  Vanillic acid.
  Veratroleacetic acid.
  Vinylacetic acid.
  α-Vinylglutaric acid.
  Vulpic acid.
  Xylenesulphamic acid.
  Xylensulphonic acids.
  α-*m*-Xylidinobutyric acid.
  m-Xylidinophenylacetic acid.
  α-*m*-Xylidinopropionic acid.
  m-Xylilpyruvic acid.
  Xylylacetic acid.
  m-Xylylacetoacetic acid.
  Xylylenebisaminobenzoic acid.

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Amylenic glycol.
Amylic and *iso*-Amylic alcohols.
Anhydro-*p*-aminobenzylic alcohol.
Anhydro-*p*-hydroxylaminobenzylic alcohol.
Anisylic alcohol.
Aspinidol.
Azelaol.
Benzeneazophenol.
Benzylic alcohol.
Betorcinol.
Borneol.
tert-iso-Butylenic glycol.
Butylic *iso*-Butylic and *tert*-Butylic alcohols.
Carvanol.
Carvenol.
Catechol.
Catechol-$\beta\gamma$-propylic alcohol.
Cedrol.
Cerylic alcohol.
Cholesterol and *iso*-cholesterol.
Citronellol.
Decylene glycol.
2 : 5-Diacetamidoquinol.
3 : 5-Diethoxy-*o*-aminophenol.
3 : 5-Diethoxycarbonyl-2-aminophenol.
3 : 5- Diethoxyethenyl-2-aminophenol.
Diethylcarbinol.
Dihydroxynaphthalene.
Dimethylheptenol.
Dimethylheptylenic glycol.
Dipropylallylcarbinol.
Dipropylbutanetriol.
Dulcitol.
Erythritol.
Ethylic alcohol.
Ethylsaffranol.
Eugenol.
Fenchocamphorol.
Fencohlenic alcohol.

Alcohols and Phenols. See also :—
Fenchylic alcohol.
Galipene alcohol.
Geraniol.
Glycerol.
Glycol.
Guaiacol.
2 : 4-Hexadi-inediol-1 : 6.
Hexylenic glycol.
Hexylic alcohol.
Hydrocœrulignone.
Hydroxybenzylideneindanedione.
Lemonol.
Leucohexamethyl-lignone-blue.
Linalool.
Mannitol.
Menthol.
2-Methoxyphenol.
Methoxyquinol.
p-Methylaminophenol.
Methyl*tert*butylallylcarbinol.
Methyl*iso*butylcarbinol.
Methylenedinaphtharesorcinol.
Methylic alcohol.
2-Methyl-6-heptanone-2-ol.
2-Methyl-6-heptanone-3-ol.
2-Methylol-1-butanol.
Methylolethylenedipiperidine.
β-Methylpentylenic glycol.
Methylpropylcarbinol.
Methyl*iso*propylcarbinol.
Naphthols.
Orcinol.
Phenetoilazophenol.
Phenol.
3-Phenyl-2 : 2-dimethylpropane-1 : 3-diol.
Phenylethylallylcarbinol.
Phenylmethylcarbinol.
Phloroglucinol.
Physol.
Pinocampheol.
Pinocarveol.
Propargylic alcohol.
Propionaldol.
Propylic and *iso*-Propylic alcohols.
Psyllostearylic alcohol.
Pyrogallol.
Pyroguaiacin.
Quinol.
Resorcinol.
Rhamnitol.
Rhodinol.
Sabinol.
Salicin.
Saligenin.
Selenonaphthol.
Selenophenol.
Selenylresorcinol.
Sorbitol.
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Thymol.

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Toluquinol.
Tolylmethylanthranol.
Tolylmethyloxanthranol.
Triethylcarbinol.
αβδ-Trihydroxy-δ-phenylhexane.
Trimethylenoldipiperidone.
Trimethylaneglycol.
Trimethylphenethylol.
Triphenylethanediol.
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Aldol.
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Benzaldehyde.
Butylxylylaldehyde.
iso-Butyraldehyde.
Chloral.
Cinnamaldehyde.
Citral.
Cuminaldehyde.
Diazoaminobenzaldehyde.
Dihydroxybenzeneazobenzaldehyde.
2 : 4-Dimethoxybenzaldehyde.
Formaldehyde.
Furfuraldehyde.
Glyceraldehyde.
Glycollic aldehyde.
Glyoxal.
Heptaldehyde.
Hydrocinnamaldehyde.
Hydroxybenzaldehyde.
p-Hydroxybenzeneazobenzaldehyde.
Hydroxynaphthaldehyde.
Hydroxypropacetal.
Levulinaldehyde.
Methoxynaphthaldehyde.
Methylglyoxal.
o-Methylphenylacetaldehyde.
Methylsalicylaldehyde.
Œnanthaldehyde.
Parahydroxybenzaldehyde.
Paraldehyde.
Δ^1-*cyclo*-Pentenealdehyde.
Phenoloxyacetaldehyde.

Aldehydes. See also :—
  Phenopentenal.
  o-Phenylbenzaldehyde.
  Phenylenedioxydiacetaldehyde.
  Phenylglyceraldehyde.
  Phenylpropiolaldehyde.
  Piperonal.
  Propaldehyde.
  Propiolaldehyde.
  Protocatechuic aldehyde.
  Salicylaldehyde.
  Succinic acid, dialdehyde of
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  Tolualdehyde.
  Trihydroxybenzaldehyde.
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  Anhalonidine.
  Anhalonine.
  Arginine.
  Atropine.
  Atroscine.
  Bebeerine.
  Brucine.
  Bulbocapnine.
  Bulbocarpine.
  Caffeidine.
  Caffeine.
  Carpaine.
  Chelidonine.
  Cinchonamine.
  Cinchonidine.
  Cinchonine.
  Cinchotine.
  Cocaine.
  Codeine.
  Coniine.
  Corybulbine.
  Corydaline and *i*-Corydaline.
  Cotarnine.
  iso-Creatinine.
  Cryptopine.
  Curarine.
  Curine.
  Diascorine.
  Ecgonine.
  Emetine.
  Eserine.
  Harmaline.
  Harmine.
  apo-Harmine.
  β-Homochelidonine.
  Homoscopolamine.
  Hydrastine.
  Hydrastinine.
  Hydrocinchonine.
  Hydrocotarnine.
  Hydrohydrastinine
  Hyoscyamine.
  Hystidine.
  Imperatorine.
  Lophophorine.
  Lupinidine.
  Lupinine.
  Lysine.
  Macleyine.
  Mandragorine.
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  Meroquinenine.
  Mezcaline.
  Morphine and *apo*-Morphine.
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  Narceine.

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  Nicotine.
  Ononine.
  Oxymorphine.
  Oxyptomaine.
  Papaverine.
  Papaveroline.
  Pellotine.
  Physostigmine.
  Pilocarpidine.
  Pilocarpine.
  Protocurarine.
  Protocuridine.
  Protocurine.
  Protopine.
  Ptomaine, $C_8H_{11}N$.
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  Retamine.
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  Strychnine.
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Acetamide.
Acetamidophenoxyaceto-*p*-phenetidide.
Acetanilide.
Acetobenzamide.
Acetohexamethyleneamide.
Acetotoluidides.
Acetoxytetramethylglutaric anilide.
α-Acetylbutanetetracarboxyamide.
Acetylpropionamide.
α-Acetyltricarballylamide.
Adipamic acid.
Amygdalylanilide.
p-Anisoilbenzylamide.
Asparagine.
Aspartamides.
Azelamic acid and azelamide.
Benzamide.
p-Benzanilide.
Benzenesulphacetanilide.
Benzenesulphobenzanilide.
Benzenesulphobutyranilide.
Benzenesulphonaphthalides.
Benzenesulphopropionanilide.
Benzo-methylamide and -dimethylamide.
Benzophenone-3 : 3′ (or 3 : 4′)-sulphonamide.
Benzopropylamide.
p-Benzoylanilide.
Benzoylbenzylamide.
Benzoylcarbonylamidophenol.
Benzoyllactanilide.
p-Benzoyloxybenzenesulphonamide.
Benzoylurethane.
Benzylcarbamide.
p-Benzylidenephenylhydrazoneallylthiocarbamide.
Benzyloxyallylthiocarbamide.
Benzylpyruvic amide.

Amides. See :—
Benzylurethane.
Butyramide and *iso*-Butyramide.
Butyrobenzamide.
Butyroethylanilide.
Butyromethylanilide.
Caffeincarboxyamide.
Carbamide.
Carbaminethioglycollanilide.
Carbanilide.
Carboxyglutaconamide.
Carbonyldimethylcarbamide
Catecholcarbodiethylamide.
Catecholcarbo-*p*-phenetidide.
Catecholcarbopiperidide.
Cinnamamide.
Cinnamylbromamide
ψ-Cumenesulphon, -methylamide, -dimethylamide, and -ethylamide.
p-Diacetanilide.
Diacetohydroxy-*p*-phenylenediamide.
4-Diaceto-2-methoxyphenolamide.
Diazocarbamide.
Dibenzamide.
Dibenzylidenephenylhydrazonethiocarbamide.
Dibenzoethylamide.
Di*iso*butylacetamide.
Dicatecholcarbethylenediamide.
Dicatecholdicarbethylenediamide.
Di-*p*-chlorophenylphosphoramide.
Diglycollanilide.
Dihydroxydicarboxyphenylacetamide.
Di-*p*-hydroxyphenyloxamide.
ββ-Dimethylglutamic acid.
Dimethylhydroxycarbamide.
Di-β-naphthylphosphoramide.
Diphenoxythiophosph-amide and -anilide.
Diphenoxythiophosphodiethylamide.
Diphenyltolylenedicarbamide.
Dithioglycollanilide.
Di-*p*-toluidodipropyldithiocarbamate.
Di-*p*-tolyloxamide.
Di-*p*-tolyloxythiophosph-amide and -anilide.
Di-*p*-tolylphosphamide.
Ethanetetracarboxymethylanilide.
Ethoxyacetanilide.
Ethoxydiphenylphthalamic acid.
p-Ethoxyphenyloxamide.
Ethylcarbamide.
Ethylmalono-methylamide and -dimethylamide.
Eugenoxyacetanilide.
Formamide.
Formanilide.
Formo-*p*-toluidide.
Formylbenzhydrylamide.
Fumaramic acid.
Furfuramide.
Glutaconamide.

Amides. See :—
Glutamic acid.
Glutamine.
cyclo-Heptanecarboxyamides.
Hydrobenzamide.
Hydroxyallylthiocarbamide.
p-Hydroxybenzenesulphonamide.
Hydroxybenzylsulphonamide.
Hydroxycarbamide.
Hydroxydiethoxyphenylcarbamide.
s-Hydroxydiethylthiocarbamide.
s-Hydroxydimethylthiocarbamide.
Hydroxydiphenylphthalamic acid.
Hydroxyethylallylthiocarbamide.
Hydroxyethylthiocarbamide.
Hydroxymethylallylthiocarbamide.
Hydroxymethylethylthiocarbamide.
Hydroxymethylthiocarbamide.
α-Hydroxy-γ-phenylcrotonamide.
p-Hydroxyphenyloxamide.
Maleamic acid.
Maleinphenylamic acid.
Malamide.
Malonanilide.
Malonomethylanilide.
Mesitylenesulphon-methylamide, -dimethylamide, and -ethylamide.
Methoxyacetanilide.
Methoxybenzenesulphonamide.
Methoxybenzylsulphonamide.
Methoxydiphenylphthalamic acid.
p-Methoxyphenyloxamide.
Methylacetophenone-α-phthalamic acid.
Methylcarbamide.
Methylfurazancarboxyamide.
Methylglyoximecarboxyamide.
2′-Methylquinoline-3′-carboxyamide.
Methylthioglycollanilide.
Naphthalenecarboxylamide.
α-Naphthaquinoline-3′-sulphonamide.
β-Naphthoxythiophosph-amide and -diamide.
Nitrosocarbonyldimethylcarbamide.
Opianamide.
Oxamic acid.
Oxanilic acid.
Oxanilide.
p-Oxyacetophenonephenylcarbamide.
Pentamethylene-xylylenediaminebenzenesulphonamide.
cyclo-Pentane-1 : 3-dicarboxyamide.
α-Phenoxypropionanilide.
Phenoxythiophospho-diamide and -dianilide.
Phenylacetamide and β-*iso*-Phenylacetamide.
Phenylaceto-methylamide and -dimethylamide.
Phenylcarbamide.
Phenylethylenecarbamide.
p-Phenylethylurethane.

Amides. See :—
  Phenyliminodiacetamide.
  Phenylmethylcarbamide.
  Phenylpropionamide.
  Phenylpropiono-methylamide and -dimethylamide.
  p-Phenylpropylurethane.
  p-Phenylsulphonebenz-amide and -anilide.
  Phenylthiocarbamide.
  Phenylthiocarbamide glycollide.
  Phenylthiourethaneacetamide.
  Propanetetracarboxyamide.
  Propionamide.
  Propionanilide.
  Propionobenzamide.
  Propionohexamethylenamide.
  Propionylethylanilide.
  Propionylmethylanilide.
  Pulegenic amide.
  Pyromucamide.
  Quinolcarbopiperidide.
  Resorcinolcarbopiperidide.
  Resorcinoldicarbodipiperidide.
  Sebamic acid and sebamide.
  Suberamic acid and suberamide.
  Succinanilide.
  Succinophenylamic acid.
  Tetracetoquinol-2 : 5-diamide.
  Tetracetoresorcinoldiamide.
  Tetramethyl*di*aminobenzenesulphanilide.
  Tetramethyl*di*aminophenylcarbamide.
  as-Tetramethyl*di*aminocarbanilide.
  Thiocarbamide.
  Thiocyanoacetanilide.
  Thioglycollanilide.
  Thymoxyacetanilide.
  Toluenedisulphonanilide.
  o- and *p*-Toluenesulphonamides.
  Toluenesulphonanilide.
  p-Toluidinoacetamide.
  α-*p*-Toluidinobutyric *p*-toluidide.
  p-Toluidinopropionamide.
  α-*p*-Toluidinopropionic *p*-toluidide.
  p-Toluidinopropylbenzamide.
  p-Toluidinopropylcarbamide.
  p-Toluidino-*o*-sulphonamide.
  p-Toluoylbenzylamide.
  Toluylenedicarbamide.
  Tolylcarbamides.
  p-Tolyltrimethylene-carbamide, -thiocarbamide and -ψ-thiocarbamide.
  Triaceto-3 : 5-diethoxyphenol-4-amide.
  Triaceto-*p*-phenylenediamide.
  Tribenzamide.
  tert-Trimethyl-β-phenyl-δ-ketohexoamide.
  Triphenylcarbinoltricarboxyamide.
  Tropylphenylthiocarbamide and ψ-Tropylphenylthiocarbamide.
  iso-Valerylethylanilide.

Amides. See :—
  Vinylideneoxanilide.
  m-Xylenesulphon-amide, -methylamide and -dimethylamide.
  p-Xylylacetamide.
  Xylylenedi*iso*butyldiamine.
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  Aniline.
  p-Anisidine.
  Benzeneazo-*m*-aminobenzeneazo-*m*-phenylenediamine.
  Benzeneazo-*m*-phenylenediamine.
  Benzhydrylamine.
  Benzylamine.
  α-Benzylhydroxylamine.
  Benzylideneacetophenoneaniline.
  Benzylideneacetophenone-β-naphthylamine.
  Benzylideneacetophenone-*p*-toluidine.
  Benzylidineaniline.
  Benzylidenedi*iso*nitramine.
  Benzylidenedimethylphenylenediamine.
  Benzylidene-α-naphthylamine.
  Benzylmethylnitramine.
  Benzylnitramine.
  Betaine.
  iso-Butylmenthylamine.
  iso-Butyl-*o*-toluidine.
  Carylamine.
  Chitosamine.
  Cumidine.
  Diazobenzaldehyde-*p*-aminophenyleneamine.
  Dibenzylideneacetophenoneamine.
  Dibenzylideneacetophenone-α-naphthylamine, -*o*-nitraniline, and -nitrotoluidine.
  Diethylamine.
  Diethyl*iso*amylamine.
  Diethylaniline.
  Diethylenediamine.
  Diethylnitramine.
  Diethylnitrosamine.
  Dihydroxytriethylamine.
  Dimethylamine.
  Dimethylaniline.
  Dimethylnitrosamine.
  Dimethyl-*p*-toluidine.
  Dimethyl-1 : 3 : 5-*m*-xylidine.

Amines. See :—
Diphenacylmethylamine.
Diphenylnitrosamine.
Ditolylamine.
Ethylamine.
Ethylaminophenol.
β-Ethylamylamine.
Ethyl*iso*amylamine.
Ethylaniline.
Ethylanisidine.
Ethylenediamine.
Ethylidenedi*iso*nitramine.
β-Ethylhydroxylamine.
Ethylmenthylamine.
Ethylnitramine.
Ethyl*iso*propylaniline.
Furfurine.
Hexamethylenetetramine.
Hexamethyltriaminobenzene.
Hexylamine.
Hydroxylamine.
Hydroxy-ψ-cumylaniline.
Hydroxydiethylamine.
Mentholamine.
Menthoneamine.
Menthylamine.
Mesidine.
Methoxyphenacyl-*p*-phenetidine.
Methylamine.
Methylaniline.
Methylasparagine.
Methyldihydroxyethylamine.
Methyldi*iso*nitramine.
Methylethylnitramine.
Methylhydroxyethylamine.
β-Naphthylamine.
Naphthylanilines.
Naphthylenediamine.
Octomethyl*di*aminobenzidine.
Octylamine.
Pentamethylenexylylenediamine.
Phenacyldimethylamine.
Phenacylmethylamine.
Phenetidine.
ε-Phenoxy-β-ethylamylamine.
Phenylaniline.
Phenylenediamines.
α-Phenylethylamine.
Phenylfenchylamine.
Phenylglycine-*p*-amidodimethylaniline.
Phenylnitramine.
Propylamines.
Propylenediamine.
Propylidenedi*iso*nitramine.
Propylmenthylamine.
Tetramethyl*di*aminobenzidine.
Tetramethyl-*m*-phenylenediamine.
Tetramethyl*tri*aminobenzene.
Tetrethylammonium compounds.
Toluhydrylamine.
Toluidines.

Amines. See :—
Tolylanilines.
p-Tolyltrimethylenediamine.
Triacetonealkadiamine.
Triacetonediamine.
Tricetylamine.
Triethylamine.
Trimethylamine.
Trimethyltrimethylenetriamine.
Tropylamine and ψ-Tropylamine.
Tyrosine.
Veratrylenediamine.
Vinylamine.
Xylidines.
Xylylene-*o*-anisidine.
Xylylene-bis-*o*-anisidine.
Xylylene-bis-*o*-chloraniline.
Xylylene-bisdi*iso*butylamine.
Xylylene-bisdiphenylamine.
Xylylenedi*iso*butyldiamine.
Xylylenedi-ψ-cumidine.
Xylylenedidiethylamine.
Xylylenediphenylmethylamine.
Xylylenedipiperidyl.
Xylyleneditoluidine.
Xylylenedixylidine.
Xylylene-α-naphthylamine.
Xylylene-*bis*-α-naphthylamine.
Xylylenepiperidyldi*iso*butylamine.
Xylylenepiperidyldiethylamine.
Amino-derivatives. See under :—
Acetic acid.
Acetophenone-*p*-aminophenol.
Acetylacetone.
Alanine.
Anhydro-*p*-aminobenzylic alcohol.
Anhydro-*p*-hydroxylaminobenzylic alcohol.
Anilidoethoxytetrahydronaphthalene.
Anisenyltetrazotic acid.
Azobenzaldehyde.
Azobenzene.
Benzacetophenylhydrazide.
Benzaldoxime.
Benzanilide.
Benzeneazo-*m*-aminobenzeneazo-*m*-phenylenediamine.
Benzeneazo-*m*-phenylenediamine.
Benzenesulphonic acid.
Benzimidazole.
Benzomethylanilide.
Benzophenone.
Benzylacetic acid.
Benzoylacetone.
Benzylic cyanide.
Benzylidene-*p*-aminobenzylidene-phenylhydrazone.
Benzylidene*di*aminocrotononitrile.
Benzylidenedi-*p*-aminoazobenzene.
Benzylideneguanidine.
Benzylidene-β-naphthylaminoaceto-acetic acid.

Amino-derivatives. See under :—
- Benzylidenephenylhydrazone.
- Benzylsulphonic acid.
- Benzylsultone.
- Bis-benzeneazo-*m*-phenylenediamine.
- Borneol.
- Butyramide.
- *iso*-Butyronitrile.
- Campholactone.
- Cannabinolactone.
- Caproic acid. (Under Leucine.)
- Carbazole.
- Catechol ethylenic ether.
- Cinnamonitrile.
- Cinnamylidene*di*aminocrotononitrile.
- Citraconimide.
- Creatine.
- Cresol.
- Deamidoalbuminic acid.
- Dibenzylidenehydrazone.
- 3 : 5-Diethoxy-*o*-aminophenol.
- 3 : 5-Diethoxyethenyl-2-aminophenol.
- Dihydroxy-*m*-xylene.
- Dimethylaminomethylazimidobenzene
- Dimethylaniline.
- Dimethylpurine.
- Diphenylamine.
- Diphenylaminesulphonic acid.
- Diphenylmethylamine.
- Diphenyltetrazole.
- Diphenyltetrazoline.
- Ditolylphthalide.
- Ethenyltriaminonaphthalene.
- Ethoxypurine.
- Ethylidenesuccinic acid.
- Ethylidenesuccinimide.
- Ethylmaleimide.
- Fluoran.
- Fumaramic acid.
- Fumaric acid.
- Glycocine.
- Glyoxime *N*-phenylic ether.
- Guaiacol.
- Hemipinic isoimidine.
- Hexamethyl*tri*aminotriphenylmethane.
- *cyclo*-Hexane.
- Hydantoic acid.
- Hydantoin.
- Hydroxybenzylideneaminobenzylidenephenylhydrazone.
- Hydroxybenzylideneguanidine.
- Hydroxydimethylpyridine.
- Hydroxydimethylquinoline.
- Hydroxylepidine.
- Hydroxymesitylene.
- Hydroxymethylethylquinoline.
- Hydroxymethyllepidine.
- Hydroxymethylquinoline.
- *p*-Hydroxyphenylpropionic acid.
- Hydroxyquinoneimide.
- Lepidine.

Amino-derivatives. See under :—
- ψ-Lutidostyril.
- ψ-Lutidostyrilcarboxylic acid.
- Maleamic acid.
- Maleic acid.
- Menthole.
- Menthone.
- Mesitylene.
- *p*-Methoxybenzylidenediaminocrotononitrile.
- Methoxycoumarin.
- 2-Methoxyphenol.
- Methylacetophenone.
- *p*-Methylaminophenol.
- Methylaniline.
- Methylaspartic acid.
- Methylazimidobenzene.
- Methylethylquinoline
- Methylethylquinolinesulphonic acid.
- Methylitaconic acid.
- Methylmenthylamine.
- μ-Methyl-*p*-phenoxyacetimidazole.
- *o*-Methylphenylacetaldehyde.
- Methylpurine.
- Methylquinoline.
- Methylquinolinecarboxylic acid.
- Methylthiohydantoin.
- Naphthaquinoline.
- α-Naphthylaniline.
- Naphthylphenylenebenzenylamidine.
- Ornithin.
- Oxymethylpurine.
- Pentane.
- *cyclo*-Pentanone.
- *cyclo*-Pentenone.
- Phenol.
- Phenolsulphonphthalein.
- Phenonaphthoxazone.
- Phenoxyacetic acid and anhydride.
- Phenylaminophenylenebenzenylamidine.
- Phenylaniline.
- Phenylbenzimidazole.
- Phenyldimethylosotriazole.
- Phenylethoxytetrahydronaphthylamine.
- Phenylic carbonate.
- Phenylic ethylenic ether.
- Phenyl*iso*naphthaphenazonium.
- Phenylphenylenebenzenylamidine.
- Phenylquinoline.
- Phenylthioglycollic acid.
- Phenylthiohydantoic acid.
- Phenylthiohydantoin.
- Phenyltolimidazoles.
- Phenyltriazole.
- Phenyltriazoledicarboxylic acid.
- Piperonylidene*di*aminocrotononitrile.
- Propionamide.
- Propionic acid. (Under Tyrosine.)
- Propyl-*p*-tolylnitrosamine.
- Purine.

Amino-derivatives See under :—
- Pyridine.
- Pyrogallol.
- Quinol.
- Quinoline.
- Quinone.
- Resorcinol.
- Strycholcarboxylic acid.
- Succinic acid.
- Tetrahydronaphthylic ethylic ether.
- Tetramethylcarbanilide.
- Tetramethyldiaminobenzhydrol.
- Tetramethyldiaminodiphenyltetramethyldianthranol.
- Tetramethyldiaminophenyloxanthranol.
- Tetramethyl-*m*-phenylenediamine.
- Tetrethylbenzene.
- Tetrethyldiaminodihydroxytriphenylmethane.
- Thiophenol.
- *p*-Toluoyl-*o*-benzoic acid.
- Tolylanilines.
- *β*-*p*-Tolylbenzimidazole.
- *p*-Tolylbenzimidazole.
- Tolylphenylenebenzenylamidine.
- *p*-Tolyltolimidazole.
- Trimethylamino*cyclo*hexane.
- Trimethyl-*p*-aminophenylium.
- 1 : 3 : 5 Trimethylbenzene.
- Triphenylmethane.
- Tyrosine.
- Urocaninic acid.
- Valeraldehyde.
- Valeric acid.
- Xylylacetone.

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- drying of, by phosphoric anhydride (BAKER), T., 422 ; P., **1898**, 99.
- solubility of, in ammonium nitrate (KURILOFF), A., ii, 156.
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Ammonium, *hyper*borate (MELIKOFF and PISSARJEWSKY), A., ii, 374.
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- carbonates and carbamate, yield of carbamide from (BOURGEOIS), A., i, 464.
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  - vapour density of dry (BAKER), T., 425 ; P., **1898**, 100.
  - heat of solution and dilution of (STACKELBERG), A., ii, 498.
  - transference ratios of, in dilute solutions (BEIN), A., ii, 553.
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  - partition of, between solid potassium chloride and water (FOCK), A., ii, 154.
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- manganic chloride (RICE), T., 260 ; P., **1898**, 53.
- *per*chromate (WIEDE), A., ii, 295.
- lead halogen salts (FONZES-DIACON), A., ii, 512.
- hydroxide, transference ratios of (BEIN), A., ii, 554.
- hydroxylaminosulphonate (SABANÉEFF), A., ii, 578.
- potassium manganimolybdate (ROSENHEIM and ITZIG), A., ii, 164.
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  Acetylphenetoilazophenol.
  Allylaminoazobenzene.
  Amidoazobenzaldehyde.
  Anilinoazo-α-naphthol.
  Anilinoazobenzene.
  Anisenyltetrazotic acid.
  Azodimethylaniline.
  Azo-*o*-toluene.
  Azoxyanisoil.
  Azoxybenzene.
  Azoxybenzoic acid.
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  Azoxytoluene.
  Benzeneazobenzoic acid.
  Benzeneazo-ψ-cumene.
  Benzeneazohydroxybenzylamide.
  3-Benzeneazo-2-hydroxynaphthaquinone.
  Benzeneazo-α-naphthalene.
  Benzeneazophenol.
  Benzeneazotetrahydronaphthylic ethylic ether.
  Benzeneazotetramethyldiaminobenzidine.
  Benzeneazo-*m*-toluene.
  Benzeneazo-*m*-xylene.
  Benzenediazocarbamide.
  Benzenediazocarbamidebenzenesulphinic acid.
  Benzenediazocarboxylic acid.
  Benzenediazocyanide.
  Benzenediazonium.
  Benzenediazosulphone.
  Benzenyldioxytetrazotic acid.
  Benzenyloxytetrazotic acid.
  Benzenyltetrazotic acid.
  Benzoylbenzeneazophenol.
  Benzoylphenetoilazophenol.
  Benzylidenedi-*p*-aminoazobenzene.
  Bisazoxybenzyl.
  Bisdiazobenzeneanilide.
  Butylchloralaminoazobenzene.
  Chloralaminoazobenzene.
  Cumenediazocyanide.
  Cumenediazonium cyanide.
  ψ-Cumene*anti*diazosulphone.
  Diacetyldiazobenzene-euxanthone.
  Diacetyltetrazobenzenehesperitin.
  Diazoaminobenzaldehyde.
  Diazoaminobenzene.
  Diazoaminotoluene.
  Diazobenzaldehyde.
  Diazobenzaldehydeaminobenzene.
  Diazobenzaldehyde-*p*-aminophenyleneamine.
  Diazobenzaldehyde-*p*-aminotoluene.
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  Diazobenzenechrysin.
  Diazobenzene-euxanthone.
  Diazobenzenemorin.
  Diazobenzene-*p*-toluenesulphinic acid.
  Diazobenzoimide.
  Diazodiphenylamine.
  Diazoguanidine.
  Diazomethane.
  Diazonium hydroxide and salts.
  p-Diazo-*o*-toluenesulphonic acid.
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  Diformazylbenzene.
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  Diphenyldisazotetramethyldiaminobenzidine.
  Diphenyltetrazochloride.
  Diphenyltriazodiphenylene.
  Disazo-colouring matters.
  Di-*p*-tolyltriazodiphenylene.
  Formamidinediazoaminoformic acid.
  Formamidoazobenzene.
  Furfurylideneaminoazobenzene.
  p-Hydroxybenzeneazobenzaldehyde.
  Hydroxydiazobenzylsulphonic acid.
  Hydroxytolueneazobenzoic acid.
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  Methylazimidobenzene.
  Methylazimidodimethylaniline.
  β-Naphthaleneazohydroxynaphthaquinone.
  Naphthalenediazocyanide.
  β-Naphthenyldioxytetrazotic acid.
  Naphthyldiazonium.
  Octylphenylazo-α-naphthol.
  Phenethenyloxytetrazotic acid.
  Phenetoilazophenol.
  Phenylazocarbamide.
  Phenylazocyanacetic acid.
  Phenylazo-β-hydroxylaminopropionic acid.
  Phenylazohydroxymethylamide.
  Phenylenediamineazophenyloxamic acid.
  Phenylene-*m*-disazo-*m*-phenylenediamine.
  Phenylformazylbenzene.
  Phenylglycolenyloxy- and dioxy-tetrazotic acid.
  Phenylhydroxyazobenzenes.
  Phenyl-*p*-toluenesulphazide.
  Pyromucazide.
  Salicylideneaminoazobenzene.
  Sulphobenzeneazobenzoic acid.
  3-*p*-Sulphobenzeneazo-2-hydroxynaphthaquinone.
  p-Sulphonaphthaleneazohydroxynaphthaquinone.
  Tetracetoxyazobenzene.
  Tetrahydronaphtholdisazobenzene.
  Tetrahydroxyazobenzene.
  Tetramethyl-*m*-phenylenediamineazobenzenesulphonic acid.
  Tetrazobenzenehesperitin.
  Tetrazodiphenyl chloride.
  Tolenyloxy- and dioxy-tetrazotic acid.
  Tolenyltetrazotic acid.
  Tolueneazobenzoic acid.
  p-Tolueneazo-ψ-cumene.
  3-*p*-Tolueneazohydroxynaphthaquinone.
  m-Tolueneazo-α-naphthalene.

Azo-compounds. See :—
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  Tolueneazophenol.
  Tolueneazosalicylic acid.
  o-Tolueneazo-*p*-toluene.
  p-Tolueneazo-*m*-xylene.
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  Tolylazohydroxybenzylamide.
  Tolyldiazonium nitrate.
  p-Tolylphenylazosulphone.
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  Trimethylazonium.
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Acetoxy-ψ-cumylic alcohol.
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Dihydro-β-camphylic acid.
Dihydro*iso*lauronolic acid.
Dihydroxybenzylideneindanone.
Dihydroxynaphthalene.
Dihydroxyphenylbutyrolactone.
2 : 4-Dihydroxypyridine.
Dihydroxypyridinecarboxylic acids.
Dihydroxytetramethylstilbene.
Dimethoxydibenzylideneacetone.
Dimethylaniline perhaloids.
Dimethylglutaric acid.
Dimethylphenacylideneflavene.
Diphenylethane.
Diphenyl ethyl ketone.
Diphenylhydroxylamine.
Ethane.
Ethoxyquinoline.

Bromo-derivatives. See under :—
  Ethylamine.
  Ethylbenzene.
  Ethylene.
  Ethylenic bromide.
  Ethylglutaric acid.
  Ethylic propylic ether.
  Ethylindolinone.
  Ethyloxindole.
  Ethylphthalimide.
  Fenchene.
  Furfuraldehydetolylhydrazone.
  Guaiacol.
  Helicin.
  Helicoidin.
  Hemipinic *iso*imidine.
  cyclo-Heptanecarboxylic acid.
  cyclo-Heptenecarboxylic acid.
  Heptylic bromide.
  Hexane.
  cyclo-Hexane.
  γδ-Hexenic acid.
  Hydrazobenzene.
  Hydrocœrulignone.
  o-Hydroxyacetophenone.
  Hydroxybenzylacetophenone.
  Hydroxybenzylideneacetophenone.
  Hydroxybenzylideneindanone.
  Hydroxybenzylidenemethyl *p*-tolyl ketone.
  Hydroxybromindone.
  Hydroxy-ψ-cumylaniline.
  p-Hydroxy-ψ-cumylic ethylic ether.
  Hydroxymethoxybenzylideneindanone.
  Hydroxyphenylbutyric acid.
  4-Hydroxytetramethylpiperidine.
  α-Hydroxyvaleric acid.
  Indone.
  Indoneacetoacetic acid.
  Indonemalonic acid.
  ψ-Ionone phenylhydrazone.
  Kolatannin.
  Lactone, $C_{10}H_{15}BrO_2$.
  Lauric acid.
  iso-Lauronolic acid.
  Maleic acid.
  Malic acid.
  Malonic acid.
  Meroquinenine.
  Methane.
  o-Methoxyphenylcarbamic acid.
  Methylamine.
  Methylethylindolinone.
  2-Methyl-6-heptanone.
  Methylindolinone.
  Methylmorphimethinmethylic iodide.
  Methylphthalimide.
  Methylpyromucic acid and bromide.
  Morin.
  Morphenol methylic ether.
  Morphine.
  Naphthalenecarboxylic acid.

Bromo-derivatives. See under :—
  Naphthaquinone.
  Naphtholazophenylbenzimidazole.
  Naphthaquinoline.
  Naphthylamine.
  Opianamide.
  Opianic chloride.
  Opiazone.
  Pentacetylkolatannin.
  Penterythritol bromhydrin.
  Phenacylideneflavene.
  Phenetoil.
  Phenetyl dimethyl diketone.
  Phenetyl methyl ketone.
  Phenolsulphonphthalein.
  Phenylacetic acid.
  Phenylbenzimidazole-azimide.
  Phenyl α-brom*iso*propyl ketone.
  Phenyldihydro*iso*indole.
  Phenyldimethylosotriazole.
  Phenyl ethyl ketone.
  Phenylhydrazine.
  Phenylhydroxylamine.
  Phenylindolinone.
  Phenyl methyl ketone.
  Phenyl β-phenylethyl ketone.
  Phenylphenylethyltriazole.
  Phenyl propyl ketones.
  Phenylsulphonehydrazobenzene.
  Phenyltolimidazole.
  Phenylurethane.
  Phenylvaleric acid.
  Phthalic acid.
  Picrin.
  Picropodophyllin.
  Pimelic acid.
  Piperidine.
  Propaldehyde.
  Propaldehyde-diethylacetal and -dimethylacetal.
  Propane.
  Propanetetracarboxylic acid.
  Propionamide.
  Propionic acid.
  Propionylbenzene.
  Propionylethylanilide.
  Propionylmethylanilide
  Propyloxindole.
  Pyruvic tolylhydrazone.
  Resorcinol.
  Resorcinolsulphonphthalein.
  Salicin.
  Salicylaldehyde.
  Salicylaldehydetolylhydrazone.
  Salicylaldoxime.
  Salicylic acid.
  Saligenin.
  Strophanthidin.
  Substance $C_8H_{13}OBr_2$.
  Succinic and *iso*-Succinic acids.
  Telluroanisoil.
  Tellurophenetoil.

Bromo-derivatives. See under :—
- Tetracetylmorin.
- Tetracetylsalicin.
- Tetramethyldiaminobenzophenone.
- Toluene.
- Tolueneazo-α-naphthol.
- Tolueneazophenol.
- Tolueneazosalicylic acid.
- Toluenediazonium.
- Toluenedisulphonic acid.
- *p*-Toluidine.
- Tolylallylthiosemicarbazide.
- *p*-Tolyl ethyl ketone.
- Tolylimidazole.
- Tolylphenylthiosemicarbazide.
- *p*-Tolyl propyl ketone.
- Tolylsemicarbazide.
- Tolyltolimidazole.
- Triacetonamine.
- Triethoxypropane.
- Triethylallylammonium.
- Triethylpropylammonium.
- Trimethyleneglycol.
- Trimethylpiperidine.
- Triphenylethylene.
- Tropinone.
- Urocanidine.
- Urocaninic acid.
- *iso*-Valeric acid.
- *iso*-Valerylethylanilide.
- Veratrole.
- α-Vinylglutaric acid.
- Vinylic ether.
- Vinylideneoxanilide.
- Xylenediazocyanide.
- Xyloquinone.
- Xylylene-*o*-anisidine.
- Xylylene-bis-*o*-bromaniline.
- Xylylene-α-naphthylamine.
- Xylyl ethyl ketone.

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Butane, β-chloro-α-nitro-, from action of phosphorus pentachloride on nitrobutylic alcohol (Pauwels), A., i, 507.

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- αα-chloronitro-, and nitro- (Shaw), A., i, 507.
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- Adipic acid.
- Dimethylsuccinic acids.
- Methylethylmalonic acid.
- *iso*-Propylmalonic acid.
- Ethylsuccinic acid.

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Acetophenonecarboxylic acid.
Acetylanisoil.
Acetylidene hydroxide.
Acetyl-α-naphthylic methylic ether.
Acetylphenetoil.
Acetylphenylacetic acid.
Acetylphenylbenzamidine.
Acetylphenylic ethylic ether.
Acetylpropionamide.
Acetylpyruvic chloralide.
Acrylic acid.
Adenine.
Albumin.
iso-Amylaminooxyquinone.
Amylic alcohol.
Anhydrocamphoronic chloride.
Aniline.
Anilinobenzoparoxazine.
Anilino-α-phenylacetic acid.
Anilino-α-propionic acid.
Anisoil.
Anisyl methyl ketone.
Azobenzene.
Azoxybenzene.
Benzaldehyde.
Benzanilidimidochloride.
Benzene.
Benzenediazocyanide.
Benzenediazonium.
Benzenylanilidoxime.
Benzodiethylacetal.
Benzodimethylacetal.
Benzoic acids.
Benzonitrile.
Benzophenone.
Benzoylpyruvic chloranilide.
Benzylbenzaldoxime.
Benzyl*iso*benzaldoxime.
Benzylhydroxylamine.
Benzylic cyanide.
Benzylidene-α-naphthylamine.
Benzylidenic chloride.
Benzylphenol.
Bisdiketohydrindene.
Bismuthotrianisyl.
Butane and *iso*-Butane.
Butylic alcohol.
Caffeine.
Camphene.
Camphor.
Carbazole.
Carbocinchomeronic acid.
Carbon tetrachloride.
Carvacrol.
Casein.
Catechol.
Chloral.
Chloroform.
Cinnamic acid.

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Cœrulignone.
Coumarone.
Cresol and *p*-Cresol.
Cyanethine.
Cyanuramide.
Cyanuric chloride.
Cymene.
Cymenesulphonic acid.
Diacetoxynaphthalene.
Diacetyldiphenylic ethylenic ether.
Di*iso*amylaminoquinone.
Dianisylstibinetrichloride.
Diazoaminobenzene.
Diazobenzene.
Diazonium bromide.
Dibenzylhydroxylamine.
β-Diethoxyacrylic acid.
Diethoxy*tetra*chlorodimethyltetroxan.
Diethoxypurine.
Dihydrobenzene.
Dihydro-β-camphylic acid.
Dihydro-*m*-xylene.
Dihydroxynaphthalene.
Dihydroxynicotinic acid.
Diketotetrahydronaphthalene.
Dimethenetetroxan.
Dimethenetrioxin.
Dimethoxymethylphthalide.
Dimethoxyquinone-diethyldiacetylacetal, and -dimethyldiacetylacetal.
Dimethoxyquinonedimethylhemiacetal.
Dimethylhypoxanthine.
Dimethyloxypurine.
Dimethylpurine.
Dimethylpyridinecarboxylic acid.
Dimethyltetroxan.
Dimethyltrioxin.
Diphenoxythiophosphamide.
Diphenoxythiophosphoryl chloride.
Diphenylbenzene.
Diphenylphosphoric chloride.
Ethane.
Ethoxymethylpurine.
Ethoxypurine.
β-Ethylamylamine.
Ethyl*iso*amylamine.
Ethylcedriret.
Ethylenic chloride.
Ethylic propylic ether.
Ethylidenebutylxylyl methyl ketone.
Ethyloxindole.
Fenchene.
Fenchenephosphonic acid.
Formazylbenzenecarboxylic acid.
Fumaric acid.
Glyceryl chlorhydrin.
Glyoxylic acid.
Guanine.
Harmine.
Helicin.

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cyclo-Heptanecarboxylic acid.
cyclo-Hexane.
Hydrobenzamide.
Hydroxyacetophenone.
Hydroxy*cyclo*hexane.
Hydroxylepidine.
Hydroxymethylethylquinoline.
Hydroxymethylquinoline.
Hydroxypropacetal.
Hydroxypropylphthalazine.
Hydroxypyridine.
Hydroxyquinoline.
Hypoxanthine.
Lepidine.
Lepidinic acid.
Leucodimethyllignone-blue.
Lutidinecarboxylic acid.
Maleic acid.
Malonic acid.
Mandelic acid.
Mandelonitrile.
Methoxybenzaldehyde.
Methoxybenzoic acid.
Methyladenine.
Methylaminomethylpurine.
Methylaniline.
Methylchloroform.
Methylenephthalyl.
Methylenic chloride.
Methylethylpyridinedicarboxylic acid.
Methylethylquinoline.
2-Methyl-6-heptanone.
o-Methylhexahydrobenzoic acid.
Methylic ether.
Methylic ethylic ether.
Methyloxypurine.
Methylphenomorpholine.
Methylphthalazine.
Methylphthalimide.
Methylpurine.
Methylquinoline.
Methylquinolinecarboxylic acid.
3-Methylxanthine.
Naphthacenequinone.
Naphthylamine.
Naphthylic phosphate.
Papaverine propochloride.
iso-Pentane.
cyclo-Pentanedione.
cyclo-Pentanone.
cyclo-Pentenedione.
cyclo-Pentenone.
Phenetoil.
Phenoxyacetone.
Phenylacetic acid.
Phenyl benzyl ketone.
Phenylbutyltriazole.
Phenylcarbamacetic acid.
Phenylchloroform.
Phenyldihydro*iso*indole.

Chloro-derivatives. See under :—
Phenyldipiperidine-*N*-phosphine.
Phenylditolylmethane.
Phenyl ethyl ketone.
Phenylic carbonate.
Phenylic ether.
Phenylic iododichloride.
Phenylic methylphosphinate.
Phenylic phosphate.
Phenylic phosphite.
Phenylic piperazinediurethane.
Phenyl methyl ketone.
Phenylmethylpyrrodiazole.
Phenylmethylpyrrodiazolone.
Phenylnaphthaphenazonium chloride.
Phenylphenazonium chloride.
Phenylphenylethyltriazole.
Phenylpropyltriazole.
Phenylpyrrodiazole.
Phenylpyrrodiazolonecarboxylic acid.
Phenylpyrrodiazolones.
Phenyl*apo*saffranine.
Phenylsulphonehydrazobenzene.
Phloroacetophenone chloride.
Propaldehydediethylacetal.
Propane.
Propionic acid.
Propylene.
Propylic alcohol.
Propylic chloride.
Propyloxindole.
Proteinochrome.
Protocatechuic acid.
Purine.
Pyridine.
Pyridinetricarboxylic acid.
Quinoline and *iso*-Quinoline.
Rosamine.
apo-Saffranone.
Salicin.
Salicylaldehyde.
Salicylaldoxime.
Salicylic acid.
Saligenin.
Selenoacetone.
Selenoacetophenone.
Succinic acid.
Succinophenylamic acid.
Telluroacetophenone.
Telluroanisoil.
Telluro-*p*-anisyl methyl ketone.
Tellurophenetoil.
Telluroresorcinol.
Telluro-*p*-tolyl methyl ketone.
Tetracetylsalicin.
Tetr*iso*amyldiamino-quinone and -oxyquinone.
Tetrethyldiaminodihydroxytriphenylmethane.
Theobromine.
Thymol.
Thymoquinone.

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  Toluenesulphonic acid.
  Tolylic methylic ethers.
  Trianisystibic acid.
  Trimethylenic chlorhydrin.
  Triphenolmethylphosphonium.
  Triphenylethanone.
  Triphenylethylene.
  Triphenylmethane.
  Vanillin.
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  Benzoyl-*p*-leucaniline.
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  Bismarck-brown.
  Carminic acid.
  Chlorophyll.
  Cholechrome.
  Chrysin.
  Chrysoidine.
  Cœrulignone.
  Crystal-violet.
  Diacetyldiazobenzene-euxanthone.
  Diamine dyes.
  Diazobenzeneapigenin.
  Diazobenzenechrysin.
  Diazobenzene-euxanthone.
  Diazobenzenemorin.
  Dimethyllignone-blue.
  Dimethylphenosaffranine.
  Dimethyl*apo*phenosaffranine.
  Dimethylrosinduline.
  Dimethylsaffranine.
  Dimethyl*apo*saffranine.
  Disazo-colouring matters.
  p-Ethoxyglauconic acid.
  Ethylsaffraninone.
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  Ethyltolusaffranine.
  Ethyltolu*apo*saffranone.
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  Flemingin.
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  Indigo.
  Indigoimine.
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  Magenta.
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  Methylaminosaffranine.
  Methylene-blue.
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  Methylphenetolyl*apo*saffranine.
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  Acraldehydeacetal.
  Anisaldehydeacetal.
  p-Azoxyanisoil.
  p-Azoxyphenetoil.
  Benzhydrol ether.
  Benzhydrol ethylic ether.
  Benzimido -*iso*butylic, -ethylic, -methylic and -propylic ethers.
  Benzobenzimidomethylic ether.
  Benzodimethylacetal.
  Benzoylbenzimido -*iso*butylic, -ethylic and -propylic ethers.
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- Ethoxybenzylideneindanedione.
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- Ethylic γ-phenylpropylic ether.
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- Morin, tetrabromo-, ethylic ether.
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- Phenoloxyacetal.
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  Cedrene.
  Cymene.
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  Dihydrobenzene.
  Dihydronaphthacene.
  Dihydro-*m*-xylene.
  2 : 3-Dimethyl-1 : 3-butadiene.
  1 : 2 : 4-Dimethylethylbenzene.
  Dimethyl*cyclo*pentane.
  Ethane.
  Ethylene.
  Ethylhexamethylene.
  Euterpene.
  Fenchelene.
  Fenchene.
  Galipene.
  Heptane and *iso*-Heptane.
  Heptylene.
  cyclo-Hexadiene.
  Hexane and *iso*-Hexane.
  cyclo-Hexane.
  cyclo-Hexene.
  Hexethylbenzene.
  Metastyrene.
  Methane.
  Methyl*cyclo*hexane.
  p-Methyloctylbenzene
  Methyl*cyclo*pentane.
  Myrcene.
  Naphthacene.
  Naphthalene.
  Nonane.
  Octane.
  Pentane and *iso*-Pentane.
  cyclo-Pentane.
  Phellandrene.
  Phenyl-*p*-*iso*propylphenylmethane.
  Pinene.
  Propylene.
  Sitostene.
  Styrene.
  Tetrahydrobenzene.
  Tetraphenylethylene.
  Toluene.
  Tolylmethylanthracene.
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  - Benzoylethylbenzamidine.
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  - Cinchomerimide.
  - Citraconimide.
  - Dibenzoyltartarethylimide.
  - Dicinnamoyltartarmethylimide.
  - Ethylideneimine.
  - Ethylmaleimide.
  - Ethylphthalimide.
  - Hydroxymethylphthalimide.
  - Hydroxyquinoneimide.
  - Indigotinimine.
  - Lactimide.
  - *o*-Methoxytoluimine.
  - Methylitaconimide.
  - Methylphthalimide.
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  - Methyl-*p*-toluidopropylphthalimide.
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  - Phenyliminodiacetamide.
  - Phenyliminodiacetimide.
  - Phenylphthalimide.
  - Phthalimide.
  - Phthalyltartarmethylimide.
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  - Propylphthalimide.
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  - *p*-Toluidopropylphthalimide.
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  Atropine.
  Benzenediazocyanide.
  Benzoic acid.
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  Cannabinolactone.
  Casein.
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  Coumarin.
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  Dimethylamine.
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  Hydroxybenzaldehyde.
  Iodoform.
  Iodospongin.
  Lepidine.
  Malonic acid.
  Methane.
  Methylene.
  Methylenic iodide.
  2-Methyl-6-heptanone.
  Methylphthalazine.
  Myosin.
  Nicotyrine.
  Nuclein.
  Phenetoil.
  Phenol.
  Phenylic iododichloride.
  Propylamine.
  Propylphthalimide.
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Acetophorone and *iso*-Acetophorone.
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Acetoxybenzylidenemethyl *p*-tolyl ketone.
Acetylacetone.
Acetylanisoil.
Acetyl*iso*butyrylmethane.
Acetylcoumarin.
Acetyl-ψ-cumene.
Acetyldiphenyldiketodihydropyrroline.
Acetyl-3′-ethyl-2′-indolinone.
Acetyl-3′-methyl-2′-indolinone.
Acetyl-α-naphthylic methylic ether.
Acetylphenetoil.
Acetylphenylic ethylic ether.
Acetyl-3′-phenyl-2′-indolinone.
Acetylthienone.
Acetyl-*p*-xylene.
iso-Amylamineoxyquinone.
Anhydrobisdimethoxydiketohydrindene.
Anilinobenzylideneacetylacetone.
Anilinobenzylidenebenzoylacetone.
Anilinotetrahydro-α-naphthaquinone.
Anisyl methyl ketone and diketone.
Anthraquinone.
Azelaone.
Benzeneazohydroxynaphthaquinone.
Benzoin.
Benzophenone.
Benzoylacetone.
p-Benzoylcumene and Benzoyl-ψ-cumene.
Benzoyldiphenyldiketodihydropyrroline.
p-Benzoyldiphenylsulphone.
Benzoylmethyl*cyclo*hexenone.
Benzoylphenyl-β-naphthyldiketodihydropyrroline.
Benzoyltrimethylacetone.
Benzylideneacetone.
Benzylideneacetophenone.
Benzylidenecoumaranone.
Benzylidenediacetylacetone.
Benzylidenedipropylketone.
Benzylideneindanone.
Benzylidenepinacolin.
Benzylidenepiperonalacetone.
Benzylideneresacetophenone.
Benzyliminoacetophenone.
Benzyliminoanisyl phenyl ketone.
Benzyliminobenzophenone.
Benzyl methyl ketone.
Benzyloxymethoxyphenylethylketone.
Benzylstyryl ketone.

Ketones and **Quinones**. See :—
Bisdiketohydrindene.
Butylxylyl-amyl ketone,-butylketone, and -methyl ketone.
Butyrylbenzene.
Camphorone.
Camphorquinone.
Carvanone.
Cedrone.
Cinnamoyldiphenyldiketodihydropyrroline.
Cinnamylideneindanedione.
Coumarone.
Deoxybenzoin.
3 : 4-Diacetylcinnamylidenecoumaranone.
Diacetamidoquinone.
Diacetyldiphenylic ethylenic ether.
Di*iso*amylaminoquinone.
Dibenzoylbutane.
Dibenzoylmethane.
Dibenzoylmethyl propyl ketone.
Dibenzylideneacetone.
Dibenzylideneacetophenone.
Dibenzylidenediethyl ketone.
Dibenzylidenepinacone.
Dibenzylidenesuberone.
Di*iso*butyl ketone.
Dicyanimidobenzoquinone.
Dicyanimidodihydroxyquinone.
3 : 4-Diethoxycinnamylidenecumaranone.
Didi*iso*amylamino-quinone and -oxyquinone.
Diethoxyquinone.
Diethylaminoanthraquinone.
Diethyl ketone.
Dihydrocamphoketone.
Dihydrocarvone.
Dihydroxyacetone.
Dihydroxybenzylideneindanone.
Dihydroxybisdiketohydrindene.
3 : 4-Dihydroxycinnamylidenecumaranone.
Dihydroxynaphthacenequinone.
Di*iso*propylacetone.
Diketodimethyldihexahydrophenyl.
Diketo-octohydrophenanthrene.
Diketotetrahydronaphthalene.
Dimethoxybisdiketohydrindene.
Dimethoxydibenzylideneacetone.
Dimethoxydiketohydrindene.
Dimethoxydiphenyltetrahydropyrone.
Dimethoxyketocoumaran.
Dimethoxyquinone.
Dimethylaminoanthranol.
Dimethylaminoanthraquinone.
Dimethylbisdiketohydrindene.
3′ : 3′-Dimethyl-2′-indolinone.
Dimethylphenacylideneflavene.
Dinaphthaquinone.
Di-β-naphthaquinone oxide.

Ketones and Quinones. See :—
- Di-*p*-oxyacetophenonediphenylpiperazine.
- Diphenacyldimethylammonium.
- Diphenacylmethylamine.
- Diphenyldiethylhydropyrone.
- Diphenyldiketodihydropyrrolines.
- Diphenyl ethyl ketone.
- Diphenyltetrahydropyrone.
- Ethoxybenzylideneindanedione.
- Ethoxybenzylidenepiperonalacetone.
- 3-Ethoxyflavone.
- Ethyldioxindole.
- Ethylideneacetylacetone.
- 3′-Ethyl-2′-indolinone.
- Ethylketobenzomorpholine.
- α-Ethylketodihydrobenzo-*p*-thiazine.
- Ethyloxindole.
- Ethylphenoxazine-*o*-quinone.
- Ethylsaffraninone.
- Ethyltolu*apo*saffranone.
- Fenchocamphorone.
- Fenchone.
- Flavone.
- *cyclo*-Formazyl methyl ketone.
- Furfuracrylideneacetone.
- Furfuracrylideneacetophenone.
- Furfurylideneindanedione.
- Heptanonesulphonal.
- Hexahydropropiophenone.
- *cyclo*-Hexyl ethyl ketone.
- Hydrocotoin.
- Hydroxyacetophenone.
- Hydroxybenzylacetophenone.
- Hydroxybenzylideneacetophenone.
- Hydroxybenzylideneindanedione.
- Hydroxybenzylideneindanones.
- Hydroxybenzylidenemethyl *p*-tolyl ketone.
- Hydroxybenzylidenepiperonalacetone.
- Hydroxybisdiketohydrindene.
- Hydroxycarbofenchonone.
- Hydroxydibenzylideneacetone.
- 3-Hydroxyflavone.
- Hydroxymethoxybenzylideneindanone.
- Hydroxymethylbenzylideneacetophenone.
- Hydroxymethylbenzylidenediacetophenone.
- Hydroxytrimethylketodihydropyridine.
- 2′-Indolinone.
- Ionone and ψ-Ionone.
- Ketobenzomorpholine.
- Ketodihydrobenzo-*p*-thiazine.
- Ketoethylhexamethylene.
- Ketopentamethylene.
- Mesityl oxide.
- Methoxybisdiketohydrindene.
- Methoxymethylbisdiketohydrindene.
- Methoxyphenacyl-*p*-phenetidine.

Ketones and Quinones. See :—
- Methylacetophenone.
- Methyl *iso*butyl ketone.
- Methylenediacetylacetone.
- 1′-Methyl-3′-ethyl-2′-indolinone.
- Methyl ethyl ketone.
- Methylfluorenone.
- 2-Methyl-6-heptanone.
- 2-Methyl-6-heptanone-2-ol.
- Methylheptenone.
- Methylhexanonesulphonal.
- Δ^6-Methyl*cyclo*hexenone-3.
- 3′-Methyl-2′-indolinone.
- Methylketobenzomorpholine.
- α-Methylketodihydrobenzo-*p*-thiazine.
- Methylketodiphenyltetrazolium.
- *p*-Methyloctylphenyl methyl ketone.
- 2-Methyl*cyclo*pentanone.
- 2-Methylphenacylideneflavene.
- *p*-Methyl-α-phthalimidoacetophenone.
- Methylpropylenediketohexamethylene.
- Methyl propyl ketone, and Methyl *iso*propyl ketone.
- Naphthacene-quinone and -diquinone.
- Naphthaleneazohydroxynaphthaquinone.
- Naphthaquinones.
- 1-Naphthoxyacetone.
- β-Naphthyl *iso*butyl ketone.
- β-Naphthyl-ethyl ketone, -methyl ketone, and -propyl ketone.
- Octylphenyl-methyl ketone and -phenyl ketone.
- *p*-Oxyacetophenonephenylcarbamide.
- Pentahydroxybenzophenone.
- *cyclo*-Pentane-1 : 3-dione.
- *cyclo*-Pentanone.
- *cyclo*-Pentene-1 : 3-dione.
- *cyclo*-Pentenone.
- Phenacyldimethylamine.
- Phenacylideneflavene.
- Phenacylmethylamine.
- Phenacyltrimethylammonium.
- Phenanthraquinones.
- Phenetyl dimethyl diketone.
- Phenetyl methyl ketone.
- Phenoxyacetone.
- Phenyl anilinoethyl ketone.
- Phenyl anilino*iso*propyl ketone.
- Phenyl benzyl ketone.
- Phenyl ethyl ketone.
- 3′-Phenyl-2-indolinone.
- Phenylketodiphenyltetrazolium.
- α-Phenylketodihydrobenzo-*p*-thiazine.
- Phenyl methylanilinoethyl ketone.
- Phenyl methyl ketone.
- Phenyl naphthylaminoethyl ketones.
- Phenyl naphthylaminopropyl ketone.
- Phenyl β-phenylethyl ketone.
- Phenyl propyl ketones.
- Phenyl toluidinoethyl ketone.

Ketones and Quinones. See :—
  Phenyl *m*-xylidino-ethyl ketone and -propyl ketone.
  Phloroacetophenone.
  Phorone.
  Pinacone.
  Pinocamphone.
  Pinocarvone.
  Piperonalresacetophenone.
  Propionylbenzene.
  iso-Propylacetone.
  Propyldioxindole.
  Propyloxindole.
  γ-Pyridone.
  Pyridoquinone.
  Quinone.
  Retenequinone.
  Selenoacetone.
  Selenoacetophenone.
  Stilbyl methyl ketone.
  Strychnine acetophenone.
  Sulphobenzeneazohydroxynaphthaquinone
  Sulphonaphthaleneazohydroxynaphthaquinone.
  Telluroacetophenone.
  Telluro-*p*-anisyl methyl ketone.
  Telluro-*p*-tolyl methyl ketone.
  Tetrahydrobenzophenone.
  Tetrahydroeucarvone.
  Tetramethyldiaminobenzophenone.
  Thymoquinone.
  Tolueneazohydroxynaphthaquinone.
  Toluquinone.
  p-Tolyl anilinoethyl ketone.
  p-Tolyl ethyl ketone and -propyl ketone.
  β-*p*-Tolyl pyridyl ketone.
  Triacetonamine.
  Trianisylstibine.
  Tribenzoylmethane.
  Trihydroxyphenyl hydroxy-β-naphthyl ketone.
  Trimethyldihydrohexone.
  Trimethyldiketotetrahydropyridine.
  1′:3′:3′: Trimethyl-2′-indolinone
  Triphenylethanone.
  Tropanetrione.
  Tropinone.
  Xylitone.
  Xylylacetone.
  Xylyl anilinoethyl ketone.
  Xylyl ethyl ketone.
  p-Xylyl methyl ketone

Ketonic acid, $C_{10}H_{18}O_3$, from tetrahydroeucarvone; semicarbazone and oxime (von Baeyer and Villiger), A., i, 676.

α-Ketonic acids, conversion of, into α-amino- acids (Erlenmeyer), A., i, 669.
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β-Ketonic acids, formation of (Ruhemann and Browning), T., 727; P., **1898**, 168.

Ketopentamethylene. See *cyclo*-Pentanone.

Ketophenylhomoparaconic acid, ethylic salt, action of sulphuric acid on (Wislicenus and Kiesewetter), A., i, 240.

Ketophenylparaconic acid, ethylic salt, action of ferric chloride on (Morrell and Crofts), T., 347; P., **1898**, 65.

Kidney, origin and percentage of lecithin in certain tumours of (Gatti), A., ii, 244.

Kjeldahl's process (O'Sullivan), A., ii, 185.

Kola, estimation of caffeine in; separation of the alkaloids from; probable presence of a diastatic ferment in (Knox and Prescott), A., i, 278.

Kolanin, composition of (Knox and Prescott), A., i, 278.

Kolatannin, extraction of, and its *tri*-, *tetra*-, *penta*- and *hexa*-bromo-derivatives (Knox and Prescott), A., i, 587.

Koppite, synthesis of (Holmquist), A., ii, 389.

Koprosterol. See Coprosterol.

Krennerite, from Colorado (Chester), A., ii, 602.

Ktypeite, a new form of calcium carbonate (Lacroix), A., ii, 604.

Kyanite from North Carolina (Pratt), A., ii, 342.

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Labradorite from Virginia (Watson), A., ii, 612.

Laccase, preparation of, free from manganese (Bertrand), A., ii, 128.
  oxidising power of, associated with manganese (Bertrand), A., i, 53, 128.

Lactic acid (i-*ethylidenelactic acid α-hydroxypropionic acid*), occurrence of, in Algerian wine (Muller), A., ii, 42.
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Lactic acid (*i-ethylidenelactic acid*, *α-hydroxypropionic acid*), action of silent electric discharge on, in presence of nitrogen (Berthelot), A., i, 559.
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  ethylic salt, action of ethylic iodide on (Purdie and Lander), T., 300; P., **1898**, 76.
Lactimide, molecular weight of (Richardson), A., i, 242.
  obtained by condensation of *p*-hydroxybenzaldehyde with hippuric acid (Erlenmeyer and Halsey), A., i, 197.
Lactone obtained by reduction of iodocannabinolactone (Wood, Spivey, and Easterfield), P., **1898**, 154.
  $C_5H_8O_2$, obtained from α-hydroxypentenoic acid (Fittig and Schaak), A., i, 197.
  $C_8H_{12}O_2$, from the oxidation of *iso*acetophorone (Bredt and Rübel), A., i, 264.
  $C_{10}H_{16}O_2$, from α-fenchocarboxylic acid (Wallach), A., i, 487.
  $C_{10}H_{15}BrO_2$ (Tiemann), A., i, 375.
  $C_{10}H_{15}BrO_2$, from potassium fencholenate (Wallach), A., i, 488.
  $C_{16}H_{14}O_5$, obtained from condensation product of orcinol with chloral hydrate; and its acetyl and benzoyl derivatives (Hewitt and Dixon), T., 400; P., **1898**, 103.
Lactones. See also:—
  Campholactone.
  Cannabinolactone.
  Dihydroxyphenylbutyrolactone.
  Dimethylanilinophthalide.
  ββ-Dimethylbutyrolactone.
  Dimethyleneglucoheptonic lactone.
  Glucoheptonic lactone.
  Hexahydrophthalide.
  γ-Hydroxy-α-*iso*butylvalerolactone.
  Hydroxydimethylhexolactone.
  Hydroxyionolactone.
  $α_1$-Hydroxy-$α_1$-methyl-α-*iso*butylglutarolactone.
  γ-Hydroxypimelolactone.
  Methylenerhamnonic lactone.
  Methylphenomorpholone.
  Oxalocitric acid, lactone of.
  Oxycannabin.
  1-Phenylnaphthalene-2-carboxy-3-methylene lactone.
Lactones. See also:—
  δ-Phenyl-δ-valerolactone-γ-carboxylic acid.
  Picropodophyllin.
  Pulegenic lactone.
  Pulegenolide.
  Rhamnonic lactone.
  Triphenylcarbinoltricarboxylolactone.
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Lactose (*milk-sugar*), action of hydrogen bromide on, in presence of ether (Fenton and Gostling), T., 556.
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  α-bromo-, ethylic salt, and action of silver on (Auwers and Betteridge), A., i, 127.
Laurionite, artificial (de Schulten), A., ii, 30, 31.
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Lauronolic acid, constitution of (Perkin), T., 815.

Lauronolic acid, behaviour towards nitric acid and nitric peroxide (Schryver), T., 561; P., **1898**, 98.
iso-**Lauronolic acid**, silver, methylic, ethylic salts; constitution; reduction; conversion into sulphocamphylic and *iso*lauronic acids (Perkin), T., 828; P., **1895**, 23; **1897**, 200; **1898**, 169.
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- **Leucæmia**, metabolism in (Moraczewski), A., ii, 395.
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  d-Galactose, nitrile of.
  iso-Heptenonitrile.
  Lactonitrile.
  Mandelonitrile.
  p-Methoxybenzylidene*di*aminocrotononitrile.
  Pentacetylgalactonic nitrile.
  Pentenonitrile.
  δ-Phenoxy-*a*-ethylvaleronitrile.
  Pinocamphonitrile.
  Piperonylidene*di*aminocrotononitrile.
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  Acetanilide.
  Acetic acid.
  Acetobenzamide.
  Acetotoluidide.
  Acetoxymethylcoumarazine.
  Acetylbutyltoluene.
  Alloxanphenylhydrazone.
  Amylenic glycol (2-*methylol*-1-*butanol*).
  iso-Amylic alcohol.
  Amyl*iso*nitramine.
  Aniline.

Nitro-derivatives. See under :—
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Anilino-α-phenylacetic acid.
Anilino-α-propionic acid.
Anisenyltetrazotic acid.
Benzacetophenylhydrazide.
Benzaldehyde.
Benzaldehyde-diethylacetal and -dimethylacetal.
Benzaldehydesulphonic acid.
Benzamidine.
o-Benzamido-*p*-nitro-β-naphthylaniline.
o-Benzamido-*p*-nitrophenylaniline.
o-Benzamido-*p*-nitrotolylaniline.
Benzanilide.
Benzanilidimido-chloride.
Benzene.
Benzeneazohydroxynaphthaquinone.
Benzeneazophenol.
Benzenylanilidoxime.
Benzenylhydrazidine.
Benzenyltetrazotic acid.
Benzhydroxamic acid.
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Benzoylbenzhydroxamic acid.
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Benzylidenedi*iso*nitramine.
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Benzylmethane.
Benzylmethylnitramine.
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Butyramide.
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Camphor.
Catechol ethylenic ether.
Cellulose.
Cholylic acid.
Cinnamic acid.
Cinnamamide.
Cinnamonitrile.
Cinnamylidene*di*aminocrotononitrile.
Coumarone.
Cresol.
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Dibenzyl-α-carboxylic acid.
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Diethylcarbinol.
Diethylnitramine.
Diethyloxamide.
Dimethylaminomethylazimidobenzene.
Dimethylaniline.
Dimethylcarbonylnitrosamine.
Dimethyllignone-blue.
Dimethylnitramine.
Dimethylphenosaffranine.
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Diphenylbenzylidenehydrotetrazone.
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Hydroxybenzophenone.
Hydroxybenzylsulphonamide.
Hydroxybenzylsulphonic acid.
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p-Hydroxyformazylbenzene.
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Hydroxyphenyl-*m*-phenyltriazole.
Hydroxytriphenyltetrazolium chloride.
ψ-Lutidostyril.
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Menthone.
Methane.
Methoxybenzylsulphonamide.
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Methoxyphenylpyruvic acid.
Methoxytriphenyltetrazolium iodide.
Methylaniline.
Methyl*iso*butylcarbinol.
Methylenedi*iso*nitramine.
iso-Methylethylnitramine.
Methylnitramine.
p-Methyloctylbenzene.
Methylpropylcarbinol.
Methyl*iso*propylcarbinol.
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Methylquinolinecarboxylic acid.
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Octane and *iso*-Octane.
Opianic amide and chloride.
m-Opindolone.
Oxycannabin.
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Phenetoil.
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Phenyl-*o*-acetaminocinnamonitrile.
Phenylacetic acid.
Phenylaniline.
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Phenylazohydroxymethylamide.
Phenylbenzylbenzylidenehydrazone.
Phenylcarbinol.
Phenylcarbostyril.
1-Phenyl-3-carboxy-4-phenylhydrazonephthalazone.
Phenyldihydro*iso*indole.
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Phenylic ethylenic ether, ethylic ether, methylic ether, propylic ether.
Phenylpropionamide.
Phenylquinoline.
Phenylsaffranine and Phenyl*apo*saffranine.
Phenylsemicarbazide.
5-Phenyltetrazole.
Phenyltriazole.
Phenyltriazoledicarboxylic acid.
Phenyltrimethylammonium nitrate.
Phenylxylylenediamine.
Picric acid.
Piperidylbutylic alcohol.
Piperonylidene*di*aminocrotononitrile.
Propane.
Propionamide.
Propylene.
Propylic alcohol.
Propylic chloride.
Propylidenedi*iso*nitramine.
Propyl*iso*nitramine.
Quinoline.
Resorcinol.
Rosinduline.
Salicylic phenylhydrazone.
Stilbenedisulphonic acid.
Styrene.
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Tetramethyl-*m*-phenylenediamine.
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Thymol.
Tolualdehyde.
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Toluidine.

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Toluidino-α-propionic acid.
Toluonitrile.
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Triacetoxy*iso*butane.
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  iso-Butylmenthylamine.
  iso-Butyric acid.
  iso-Butyronitrile.
  Campholactone.
  Camphor,
  Carbonyldimethylcarbamide.
  Carvacrol.
  Cresol.
  Diacetylbutanediol.
  tert-Diacetylpentandiol.
  Di*iso*butyl ketone.
  Diethylnitrosamine.
  Di*iso*propylacetone.
  Di*iso*butyl ketone.
  Dimethylaniline.
  Dimethylanilino-phthaloylic and -hydrophthaloylic acids.
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  Dimethyl-*m*-xylidine.
  Dioxalacetoguanidine, ethylic salt of.
  Diphenylhydroxylamine.
  Diphenylnitrosamine.
  Ditolylhydroxylamine.
  Ethyl*iso*amylamine.
  Ethylmenthylamine.
  Guaiacol.
  Hydroxyphenylhydrazine.
  Hydroxyurethane benzylic ether.
  Meroquinenine.
  Mesitylene.
  p-Methylaminophenol.
  Methylaniline.
  Methyl *iso*butyl ketone.
  Methylmenthylamine.
  Morpholine.
  Naphthol.
  Octane.
  Pentamethylenexylylenediamine.
  Phenol.
  Phenolphthalide.
  Phenolphthaloylic acid.
  Phenyl anilinoethyl ketone.
  Phenylhydroxylamine.
  Pinene.
  α-Pipecoline.
  Propane.
  iso-Propylacetone.
  Propylmenthylamine.
  Propyl-*p*-tolylamine.
  Tetrahydroquinoline.
  Thymol.
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  Citraconic acid.
  Glutaconic acid.
  Itaconic acid.
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  - Albumoses.
  - Amphipeptone.
  - Antialbumide (Kühne's).
  - Antipeptone.
  - Casein.
  - Caseinogen.
  - Conglutin.
  - Cystein.
  - Cystin.
  - Deamidoalbuminic acid.
  - Deuteroalbumose.
  - Deuteroproteose.
  - Dysofibrinose.
  - Edestin.
  - Elastin.
  - Ferropeptone.
  - Fibrin.
  - Fibrinogen.
  - Fibrinoglobulin.
  - Globin.
  - Globulin.

Proteids. See also :—
Globulins (from maize).
Glucoproteids.
Glutins.
Glutin-peptone.
Glycinin.
Hæmoglobin.
Hemipeptone.
Heteroalbumose.
Heterofibrinose.
Histon.
Iodospongin.
Lecithin.
Legumelin.
Legumin.
Maize-edestin.
Maize-globulin.
Maysin.
Myoglobulin.
Myosins.
Nuclein.
Ovomucin.
Oxyprotosulphonic acid.
Paraglobulin.
Peptone.
Phaseolin.
Proteose.
Protoalbumose.
Protofibrinose.
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Salmin.
Somatose.
Sturin.
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Cane-sugar (*sucrose*).
Caroubinose.
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d-Fructose (*levulose*).
Galactoses.
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Glucose (*dextrose*).
Glutose.
Lactose.
Levulose.
Lyxose.
Maltose and *iso*-Maltose.

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  Mannitol.
  d-Mannose.
  Melibiose.
  Methylpentose.
  Milk-sugar (*lactose*).
  Pentoses.
  Raffinose (*melitose*).
  Rhamnitol.
  Rhamnose.
  Saccharose (*sucrose*).
  Sorbinose.
  Sorbitol.
  Sorbose.
  Sucrose.
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  Benzenesulphonhydroxamic acid.
  p-Benzoyldiphenylsulphone.
  Cresolsulphonphthalein.
  ψ-Cumene*anti*diazosulphone.
  Diphenyldiallyldisulphoneoxydisulphide.
  Di-*p*-tolylsulphonephenylhydrazine.
  p-Methoxysulphonefluorescein.
  Naphthylallylsulphone sulphide.
Sulphones. See :—
  Naphthyldiamylallyltrisulphone.
  Orcinolsulphonphthalein.
  Phenolsulphonphthalein and Phenolsulphonphthalin.
  Phenylallyldiamyltrisulphone.
  Phenylallyldisulphone.
  p-Phenylsulphonebenzoic acid.
  Pyrogallolsulphonphthalein.
  Quinolsulphonphthalein.
  Resorcinolsulphonphthalein.
  Toluenesulphonic acid ethylsulphone.
  Tolylallyldisulphone.
  p-Tolylallylsulphonesulphide.
  Tolyldiamylallyltrisulphone.
  p-Tolyldiphenylallyltrisulphone.
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o-**Toluidine-4 : 5-disulphonic acid**, and its potassium and barium salts (Wynne and Bruce), T., 744; P., **1898**, 168.

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p-**Tolylic** methylic ether (Orndorff, Terasse, and Morton), A., i, 130.
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ERRATA.

Vol. LXIV. (Abstr., 1893).

Part II.

Page	Line	
444	11	*for* “+58·1” *read* “−58·1.”
445	4	,, “C_3H_6” *read* “C_3H_6O.”

Vol. LXVIII. (Abstr., 1895).

Part I.

381	22*	*for* “fenchone” *read* “fenchene.”
525	17*	,, “$C_7H_7{\cdot}N{:}CH{\cdot}CO{\cdot}C_7H_7$” *read* “$C_7H_7{\cdot}N{:}CH{\cdot}CO{\cdot}NH{\cdot}C_7H_7$.”

Vol. LXX. (Abstr., 1896).

Part I.

464	13	*for* “two methylene hydrogen atoms by,” *read* “ketonic oxygen atom by two.”

Part II.

Index.

728	16	Col. ii, *for* “carbides” *read* “borides.”

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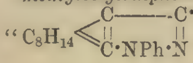
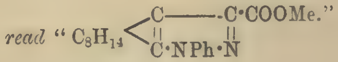
* From bottom.

Vol. LXXIV. (Abstr., 1898).

Part I.

26	11*	*for* "$NH<\begin{matrix}CMe:C(CN)\\CMe:C(CN)\end{matrix}>NPh$" *read* "$NH<\begin{matrix}CMe:C(CN)\\CMe:C(CN)\end{matrix}>CHPh$."
45	5 and 6	,, "*aμ-dimethyloxalidine*" read "*aμ-dimethyloxazolidine.*"
243	22	,, "*ethylallylhydantoin*" read "*ethylallylthiohydantoin.*"
,,	,,	,, "*ethylphenylhydantoin* ' read "*ethylphenylthiohydantoin.*"
247	24	,, "bromacetophone" *rea* "bromacetophenone."
253	2*	,, "$COPh·CO·CH_2·$," &c., *read* "$COPh·CH_2·$," &c.
362	5*	,, "$C_6HBr(NO_2)O_2Ba$" *read* "$C_6HBr(NO_2)_2O_2Ba$."
423	23*	,, "*methyloctylsulphonic*" read "*methyloctylbenzenesulphonic.*"
444	2*	,, "$C_8H_{14}<\begin{matrix}C——C·COOMe\\C·NPh·N\end{matrix}$" *read* "$C_8H_{14}<\begin{matrix}C——C·COOMe\\C·NPh·N\end{matrix}$."
476	7* 5* 3*	,, "$OMe·C_6H_4·$," &c., *read* $OMe·C_6H_3Me·$," &c.
490	9*	*delete* "(this vol., i, 289).
512	21*	*for* "*ethylic*" *read* "*methylic*
530	18	,, "Tschewsky" *read* "Ischewsky."
582	11	,, "**Harries, C.**," *read* **Harries, C., and F. Kaiser**."
628	8	,, "628" *read* "654."

Part II

75	11	*for* "Weissbach" *read* "Weisbach."
91	15	,, "some barium sulphate" *read* "the barium sulphate."
124	19*	*after* "Analysis" *insert* "by J. C. H. Mingaye."
299	10 & 12	,, "dogfish" *read* "seal."
382	2*	*delete* "$ZrSO_4$."
392	18	*for* "Eugen Ludwig" *read* "Ernst Ludwig."
397	2*	,, "**Shieweck**" *read* "**Schieweck.**"
437	19	,, "**Kubeite**" *read* "**Rubrite.**"
,,	19*	*delete* "**Thorite.**"
,,	17*	*for* "at Cleveland" *read* "in Cleveland Co."
,,	3*	,, "Columbia" *read* "Colombia."
438	7	,, "29·23" *read* "29·28."
,,	14*	,, "zircon with" *read* "zircons containing."
650	24*	,, "**Meltzer**" *read* "**Melzer.**"

Index.

Page	Col.	
704	i,	*for* "**Niemantowski**" *read* "**Niementowski.**"
756	ii,	*delete* "Imperatorine" from List of Alkaloids.
858	ii,	Line 2, *for* "oroselone" *read* "oreoselone."

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* From bottom.

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